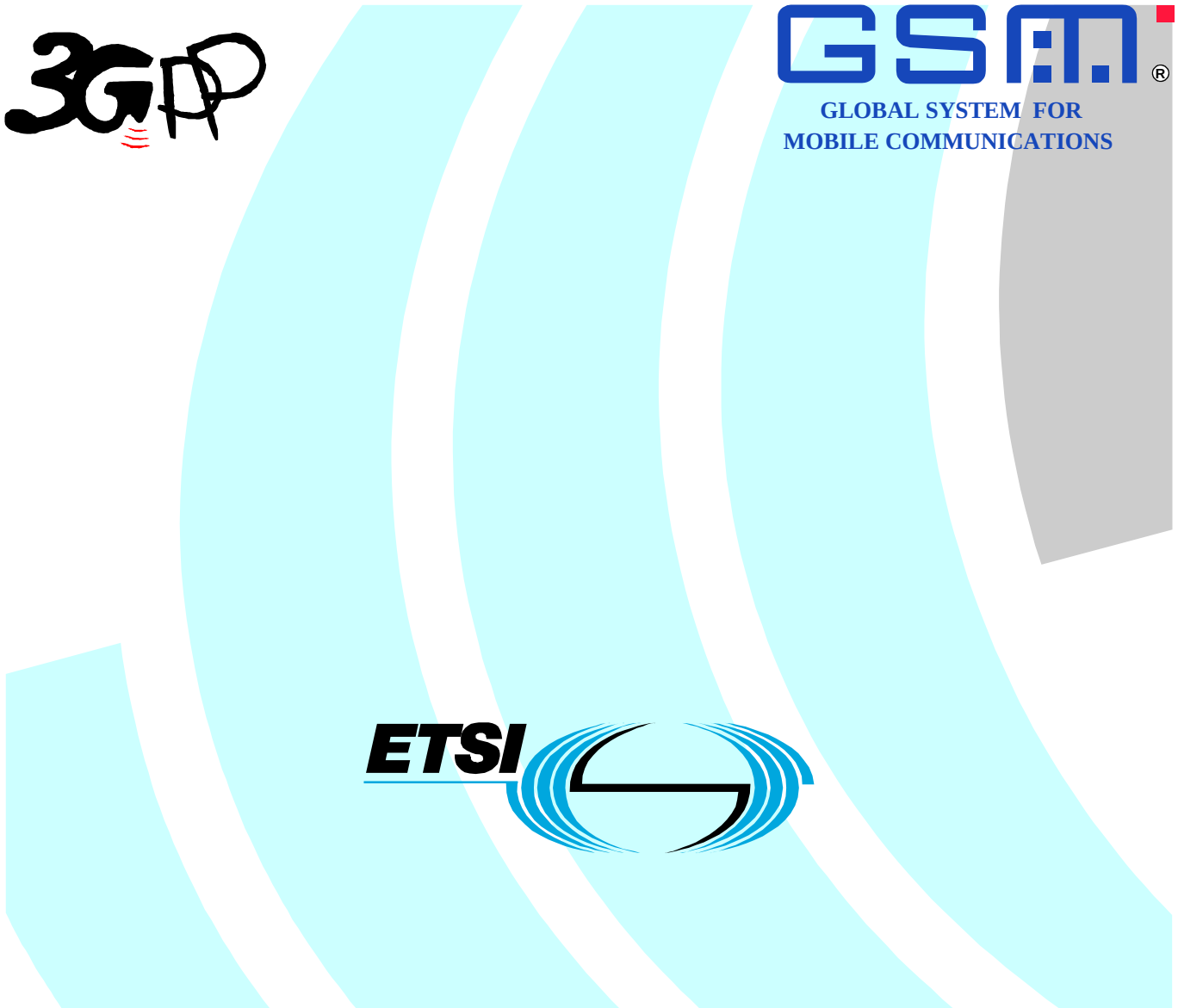
ETSI TS 129 018 V3.9.0 (2002-03)

Technical Specification

**Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
General Packet Radio Service (GPRS);
Serving GPRS Support Node (SGSN) -
Visitors Location Register (VLR);
Gs interface layer 3 specification
(3GPP TS 29.018 version 3.9.0 Release 1999)**



Reference
RTS/TSGN-0129018UR9

Keywords
GSM, UMTS

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from:
http://www.etsi.org

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status.
Information on the current status of this and other ETSI documents is available at
http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, send your comment to:
editor@etsi.fr

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2002.
All rights reserved.

DECT™, **PLUGTESTS**™ and **UMTS**™ are Trade Marks of ETSI registered for the benefit of its Members.
TIPHON™ and the **TIPHON logo** are Trade Marks currently being registered by ETSI for the benefit of its Members.
3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under www.etsi.org/key .

Contents

Intellectual Property Rights 2
Foreword 2
Foreword 7
Introduction 7
1 Scope 8
2 References 8
2.1 Normative references 8
2.2 Informative references 9
3 Definitions, symbols and abbreviations 11
4 Description of the association between a VLR and an SGSN 11
4.1 Association at the VLR 11
4.1.1 States at the VLR 11
4.2 Association at the SGSN 12
4.2.1 MM context variables at the SGSN 12
4.2.2 States at the SGSN 13
5 Paging for non-GPRS services procedure 14
5.1 General description 14
5.2 Procedures in the VLR 14
5.2.1 Paging Initiation 14
5.2.2 Paging Response 14
5.2.3 Paging Failure 14
5.2.4 MS unreachable 14
5.3 Procedures in the SGSN 14
6 Location Update for non-GPRS services procedure 15
6.1 General description 15
6.2 Procedures in the SGSN 16
6.2.1 Location Update Initiation 16
6.2.2 Location Update Response 17
6.2.3 Location Update Failure 18
6.2.4 Abnormal cases 18
6.3 Procedures in the VLR 18
6.3.1 Location Update Response 18
6.3.2 Location Update Failure 18
6.3.3 TMSI reallocation procedure 19
6.3.4 Abnormal cases 19
7 Non-GPRS alert procedure 20
7.1 General description 20
7.2 Procedures in the VLR 20
7.2.1 Alert Initiation 20
7.2.2 Alert Response 20
7.2.3 Alert failure 20
7.2.4 Alert Indication 20
7.2.5 Abnormal cases 20
7.3 Procedures in the SGSN 20
7.3.1 Alert response 20
7.3.2 Alert failure 20
7.3.3 Alert indication 21
8 Explicit IMSI detach from GPRS services procedure 21
8.1 General description 21
8.2 Procedures in the SGSN 21

8.2.1 Explicit GPRS detach initiation 21
8.2.2 Explicit GPRS detach Response 22
8.2.3 Abnormal cases 22
8.3 Procedures in the VLR 22

9 Explicit IMSI detach from non-GPRS services procedure 22
9.1 General description 22
9.2 Procedures in the SGSN 22
9.2.1 Explicit IMSI detach initiation 22
9.2.2 Explicit IMSI detach Response 23
9.2.3 Abnormal cases 23
9.3 Procedures in the VLR 23

10 Implicit IMSI detach from non-GPRS services procedure 23
10.1 General description 23
10.2 Procedures in the SGSN 24
10.3 Procedures in the VLR 24

11 VLR failure procedure 24
11.1 General description 24
11.2 Procedures in the VLR 24
11.2.1 VLR Reset Initiation 24
11.2.2 VLR Reset Response 24
11.2.3 Abnormal cases 24
11.3 Procedures in the SGSN 25

12 SGSN failure procedure 25
12.1 General description 25
12.2 Procedures in the SGSN 25
12.2.1 SGSN Reset Initiation 25
12.2.2 SGSN Reset Response 25
12.2.3 Abnormal cases 25
12.3 Procedures in the VLR 25

13 HLR failure 26
13.1 General description 26
13.2 Procedures in the SGSN 26

14 MS Information procedure 26
14.1 General description 26
14.2 Procedures in the VLR 26
14.3 Procedures in the SGSN 27

15 MM information procedure 27
15.1 General description 27
15.2 Procedures in the VLR 27
15.3 Procedures in the SGSN 27

16 Error Handling and Future Compatibility 27
16.1 General 27
16.2 Message too short 28
16.3 Unknown or unforeseen message type 28
16.4 Missing mandatory information element 28
16.5 IEs unknown or unforeseen in the message 28
16.6 Out of sequence IEs 28
16.7 Repeated IEs 29
16.8 Syntactically incorrect mandatory IE. 29
16.9 Syntactically incorrect optional IEs 29
16.10 Conditional IE errors 29
16.11 IEs with semantically incorrect contents 29

17 Message functional definitions and contents 29
17.1 Message Contents 29
17.1.1 BSSAP+-ALERT-ACK message 29
17.1.2 BSSAP+-ALERT-REJECT message 30

17.1.2.1 Gs Cause 30
17.1.3 BSSAP+-ALERT-REQUEST message 30
17.1.4 BSSAP+-DOWNLINK-TUNNEL-REQUEST message 30
17.1.5 BSSAP+-GPRS-DETACH-ACK message 31
17.1.6 BSSAP+-GPRS-DETACH-INDICATION message 31
17.1.6.1 Cell global identity (A/Gb mode only) 31
17.1.6.2 Service area identification (Iu mode only) 31
17.1.7 BSSAP+-IMSI-DETACH-ACK message 32
17.1.8 BSSAP+-IMSI-DETACH-INDICATION message 32
17.1.8.1 Cell global identity (A/Gb mode only) 32
17.1.8.2 Location information age 32
17.1.8.3 Service area identification (Iu mode only) 32
17.1.9 BSSAP+-LOCATION-UPDATE-ACCEPT message 32
17.1.9.1 New TMSI, or IMSI 33
17.1.10 BSSAP+-LOCATION-UPDATE-REJECT message 33
17.1.11 BSSAP+-LOCATION-UPDATE-REQUEST message 34
17.1.11.1 Old location area identifier 34
17.1.11.2 New cell global identity 34
17.1.11.3 TMSI status 34
17.1.11.4 Mobile station classmark 34
17.1.11.5 New service area identification 34
17.1.12 BSSAP+-MM-INFORMATION-REQUEST 35
17.1.12.1 MM information 35
17.1.13 BSSAP+-MOBILE-STATUS message 35
17.1.13.1 IMSI 35
17.1.14 BSSAP+-MS-ACTIVITY-INDICATION message 35
17.1.14.1 Cell global identity (A/Gb mode only) 36
17.1.14.2 Service area identification (Iu mode only) 36
17.1.15 BSSAP+-MS-INFORMATION-REQUEST message 36
17.1.16 BSSAP+-MS-INFORMATION-RESPONSE message 36
17.1.16.1 IMEI 36
17.1.16.2 IMIESV 37
17.1.16.3 Cell global identity (A/Gb mode only) 37
17.1.16.4 Location information age 37
17.1.16.5 Mobile station state 37
17.1.16.6 TMSI 37
17.1.16.7 Service area identification (Iu mode only) 37
17.1.17 BSSAP+-MS-UNREACHABLE message 37
17.1.17.1 Gs Cause 37
17.1.18 BSSAP+-PAGING-REJECT message 37
17.1.19 BSSAP+-PAGING-REQUEST message 38
17.1.19.1 TMSI 38
17.1.19.2 Location area identifier 38
17.1.19.3 Channel needed 38
17.1.19.4 eMLPP priority 38
17.1.20 BSSAP+-RESET-ACK message 39
17.1.20.1 SGSN number 39
17.1.20.2 VLR number 39
17.1.21 BSSAP+-RESET-INDICATION message 39
17.1.21.1 SGSN number 39
17.1.21.2 VLR number 39
17.1.22 BSSAP+-TMSI-REALLOCATION-COMPLETE message 40
17.1.22.1 Cell global identity (A/Gb mode only) 40
17.1.22.2 Service area identification (Iu mode only) 40
17.1.23 BSSAP+-UPLINK-TUNNEL-REQUEST message 40

18 Message format and information element coding 41
18.1 Overview 41
18.2 Message type 41
18.3 Information Element Identifiers 42
18.4 Information elements 42
18.4.1 Cell global identity 42

18.4.2 Channel needed 43
18.4.3 Downlink Tunnel Payload Control and Info 43
18.4.4 eMLPP Priority 43
18.4.5 Erroneous message 44
18.4.6 GPRS location update type 44
18.4.7 Gs cause 44
18.4.8 IMEI 45
18.4.9 IMEISV 46
18.4.10 IMSI 46
18.4.11 IMSI detach from GPRS service type 47
18.4.12 IMSI detach from non-GPRS service type 47
18.4.13 Information requested 48
18.4.14 Location area identifier 48
18.4.15 Location information age 48
18.4.16 MM information 49
18.4.17 Mobile identity 49
18.4.18 Mobile station classmark 1 49
18.4.19 Mobile station state 50
18.4.20 PTMSI 50
18.4.21 Reject cause 51
18.4.21b Service Area Identification 51
18.4.22 SGSN number 51
18.4.23 TMSI 52
18.4.24 TMSI status 52
18.4.25 Uplink Tunnel Payload Control and Info 53
18.4.26 VLR number 53

19 List of system variables 54
19.1 Timers 54
19.2 Retry counters 55

20 Procedures for Tunnelling Non-GSM Signalling 55
20.1 Procedures in the non-GSM MSC/VLR 55
20.2 Procedures in the SGSN 55

Annex A (informative): Change history 57

History 59

Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).

The present document specifies procedures used between the Serving GPRS Support Node (SGSN) and the Visitors Location Register (VLR) for co-ordination between GSM circuit switched services and GSM packet data services within the 3GPP system.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

The present document specifies or references the procedures to provide co-ordination between the GSM circuit switched services controlled at the Visitors Location Register (VLR) and the GSM packet switched services controlled at the Serving GPRS Support Node (SGSN). The procedures specified in the present document are intended to optimise the use of the resources when an MS supports both GSM circuit switched services and GSM packet switched services.

1 Scope

The present document specifies or references procedures used on the Serving GPRS Support Node (SGSN) to Visitors Location Register (VLR) interface for interoperability between GSM circuit switched services and GSM packet data services.

The present document specifies the layer 3 messages and procedures on the Gs interface to allow coordination between databases and to relay certain messages related to GSM circuit switched services over the GPRS subsystem.

The functional split between VLR and SGSN is defined in 3GPP TS 23.060. The required procedures between VLR and SGSN are defined in detail in the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

2.1 Normative references

[1] 3GPP TS 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[1a] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 02.06: "Digital cellular telecommunications system (Phase 2+); Types of Mobile Stations (MS)".

[3] 3GPP TS 02.07: "Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) features".

[4] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service description; Stage 1".

[5] 3GPP TS 23.003: "Numbering, addressing and identification".

[6] 3GPP TS 23.007: "Restoration procedures".

[7] 3GPP TS 23.122: "Functions related to Mobile Station (MS) in idle mode and group receive mode".

[8] 3GPP TS 23.060: " General Packet Radio Service (GPRS); Service description; Stage 2".

[9] 3GPP TS 03.64: "General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2".

[10] 3GPP TS 24.007: " Mobile radio interface signalling layer 3; General aspects".

[11] 3GPP TS 24.008: " Mobile radio interface Layer 3 specification (CC and MM parts)".

[12] 3GPP TS 04.64: "Digital cellular telecommunications system (Phase 2+), General Packet Radio Service (GPRS); Logical Link Control (LLC)".

[13] 3GPP TS 04.65: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Subnetwork Dependent Convergence Protocol (SNDCP)".

[14] 3GPP TS 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile services Switching Centre - Base Station System (MSC-BSS) interface; Layer 3 specification".

[15] 3GPP TS 08.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Base Station System (BSS); BSS GPRS Protocol (BSSGP)".

[16] 3GPP TS 08.60: "Digital cellular telecommunications system (Phase 2+); Inband control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels."

[17] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[18] 3GPP TS 09.08: "Digital cellular telecommunications system (Phase 2+); Application of the Base Station System Application Part (BSSAP) on the E-interface".

[19] 3GPP TS 29.010: "General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR): Gs interface Layer 2 specification".

[20] 3GPP TS 29.016: "Serving GPRS Support Node (SGSN) - Visitors Location Register (VLR); Gs interface Layer 2 specification".

[21] CCITT Recommendation E.164: "Numbering plan for the ISDN era".

[22] 3GPP TS 25.413: "UTRAN Iu interface RANAP signalling".

2.2 Informative references

[22A] 3GPP TS 01.61: "Digital cellular telecommunications system (Phase 2+); GPRS ciphering algorithm requirements".

[23] 3GPP TS 22.001: "Principles of circuit telecommunication services supported by a GSM Public Land Mobile Network (PLMN)".

[24] 3GPP TS 22.002: "Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[25] 3GPP TS 22.003: "Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[26] 3GPP TS 02.08: "Digital cellular telecommunications system (Phase 2+); Quality of service".

[27] 3GPP TS 02.09: "Digital cellular telecommunications system (Phase 2+); Security aspects".

[28] 3GPP TS 22.011: "Service accessibility".

[29] 3GPP TS 22.016: "International Mobile station Equipment Identities (IMEI)".

[30] 3GPP TS 02.17: "Digital cellular telecommunications system (Phase 2+); Subscriber identity modules Functional characteristics".

[31] 3GPP TS 22.030: "Man-Machine Interface (MMI) of the Mobile Station (MS)".

[32] 3GPP TS 03.61: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Point to Multipoint Multicast Service Description; Stage 2".

[33] 3GPP TS 03.62: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Point to Multipoint Group Call Service Description; Stage 2".

[34] 3GPP TS 04.01: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS-BSS) interface; General aspects and principles".

[35] 3GPP TS 24.002: "GSM - UMTS Public Land Mobile Network (PLMN) access reference configuration".

[36] 3GPP TS 04.03: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS-BSS) interface; Channel structures and access capabilities".

[37] 3GPP TS 04.04: "Digital cellular telecommunications system (Phase 2+); Layer 1 General requirements".

[38] 3GPP TS 04.05: "Digital cellular telecommunications system (Phase 2+); Data Link (DL) layer General aspects".

[39] 3GPP TS 04.06: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[40] 3GPP TS 24.011: "Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[41] 3GPP TS 04.22: "Digital cellular telecommunications system (Phase 2+); Radio Link Protocol (RLP) for data and telematic services on the Mobile Station - Base Station System (MS-BSS) interface and the Base Station System - Mobile-services Switching Centre (BSS-MSC) interface".

[42] 3GPP TS 27.060: "Mobile Station (MS) supporting GPRS".

[43] 3GPP TS 08.06: "Digital cellular telecommunications system (Phase 2+); Signalling transport mechanism specification for the Base Station System – Mobile-services Switching Centre (BSS-MSC) interface".

[44] 3GPP TS 08.14: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Base Station System (BSS); Gb interface layer 1".

[45] 3GPP TS 08.16: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Base Station System (BSS): Network Service".

[46] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

[47] 3GPP TS 29.061: "General requirements on interworking between the Public Land Mobile Network (PLMN) supporting General Packet Radio Service (GPRS) and Packet Data Networks (PDN)".

[48] 3GPP TS 12.00 (ETS 300 612-1): "Digital cellular telecommunications system (Phase 2+); Objectives and structure of Network Management (NM)".

[49] 3GPP TS 12.01 (ETS 300 612-2): "Digital cellular telecommunications system (Phase 2+); Common aspects of GSM Network Management (NM)".

[50] 3GPP TS 12.02: "Digital cellular telecommunications system (Phase 2+); Subscriber, Mobile Equipment (ME) and services data administration".

[51] 3GPP TS 12.03: "Digital cellular telecommunications system (Phase 2+); Security management".

[52] 3GPP TS 12.13: "Digital cellular telecommunications system (Phase 2+); Maintenance of the Mobile-services Switching Centre (MSC)".

[53] 3GPP TS 12.14: "Digital cellular telecommunications system (Phase 2+); Maintenance of location registers".

[54] 3GPP TS 12.20: "Digital cellular telecommunications system (Phase 2+); Network Management (NM) procedures and messages".

[55] 3GPP TS 12.22: "Digital cellular telecommunications system (Phase 2+); Interworking of GSM Network Management (NM) procedures and messages at the Base Station Controller (BSC)".

[56] CCITT Recommendations I.130: "General modelling methods - Method for the characterisation of telecommunication services supported by an ISDN and network capabilities of an ISDN".

[57] CCITT Recommendation Q.65: "Methodology - Stage 2 of the method for the characterization of services supported by an ISDN".

[58] CCITT Recommendation Q.702: "Specifications of Signalling System No. 7 - Signalling data link".

[59] CCITT Recommendation Q.703: "Signalling link".

[60] CCITT Recommendation Q.704: "Signalling network functions and messages".

[61] CCITT Recommendation Q.711 (3/93): "Functional description of the signalling connection control part".

[62] CCITT Recommendation Q.712 (3/93): "Definition and function of SCCP messages".

[63] CCITT Recommendation Q.713 (3/93): "SCCP formats and codes".

[64] CCITT Recommendation Q.714 (3/93): "Signalling connection control part procedures".

[65] ANSI Recommendation T1.111 (1996): "Signalling System 7 (SS7) Message Transfer Part (MTP)".

[66] ANSI Recommendation T1.112 (1996): "Signalling System 7 (SS7) Signalling Connection Control Part (SCCP)".

3 Definitions, symbols and abbreviations

Unless listed below, the definitions, symbols and abbreviations are listed in 3GPP TS 01.04 or 3GPP TS 23.060.

4 Description of the association between a VLR and an SGSN

The Gs interface connects the databases in the MSC/VLR and the SGSN. The procedures described in this technical specification are used to co-ordinate the location information of MSs that are IMSI attached to both GPRS and non-GPRS services. The Gs interface is also used to convey some circuit switched related procedures via the SGSN.

The basis for the interworking between a VLR and an SGSN is the existence of an association between those entities per MS. An association consists of the SGSN storing the number of the VLR serving the MS for circuit switched services and the VLR storing the number of the SGSN serving the MS for packet switched services. The association is only applicable to MSs in class-A mode of operation and MSs in class-B mode of operation.

All the messages described in the present document use the SCCP class 0 connectionless service.

When the return option in SCCP is used and the sender receives an N_NOTICE indication from SCCP, the sending entity shall report to the Operation and Maintenance system (see ITU-T Recommendation Q.714).

The behaviour of the VLR and the SGSN entities related to the Gs interface are defined by the state of the association for an MS. Individual states per association, i.e. per MS in class-A mode of operation and MS in class-B mode of operation, are held at both the VLR and the SGSN.

4.1 Association at the VLR

The states associated to the Gs interface in the VLR are specified in this subclause. The state diagram at the VLR is shown in figure 4.1. The state diagram does not include the message error handling specified in clause 16.

4.1.1 States at the VLR

Gs-NULL:

There is no association with an SGSN for the MS and therefore the VLR considers that the MS is IMSI detached for GPRS services. In this state no BSSAP+-MS-INFORMATION-REQUEST or BSSAP+-MM-INFORMATION-REQUEST messages are sent to the SGSN. The VLR may initiate paging on the Gs interface if the 'Confirmed by Radio Contact' restoration indicator in the VLR is set to 'false' (see 3GPP TS 23.007). Any message from the SGSN is ignored apart from the BSSAP+-LOCATION-UPDATE-REQUEST message.

LA-UPDATE PRESENT:

The VLR has received a BSSAP+-LOCATION-UPDATE-REQUEST message from the SGSN. In this state the VLR may be waiting for the outcome of the Update Location procedure from the HLR. The VLR shall send BSSAP+-PAGING-REQUEST messages to MSs in class-A and MSs in class-B mode of operation via only the Gs interface.

Gs-ASSOCIATED:

The VLR considers that the MS is attached to both GPRS and non-GPRS services. In this state the VLR sends BSSAP+-PAGING-REQUEST messages to MSs in class-A mode of operation and and MSs in class-B mode of operation via only the Gs interface. The VLR can perform the MS Identification procedure and the MM information procedure.

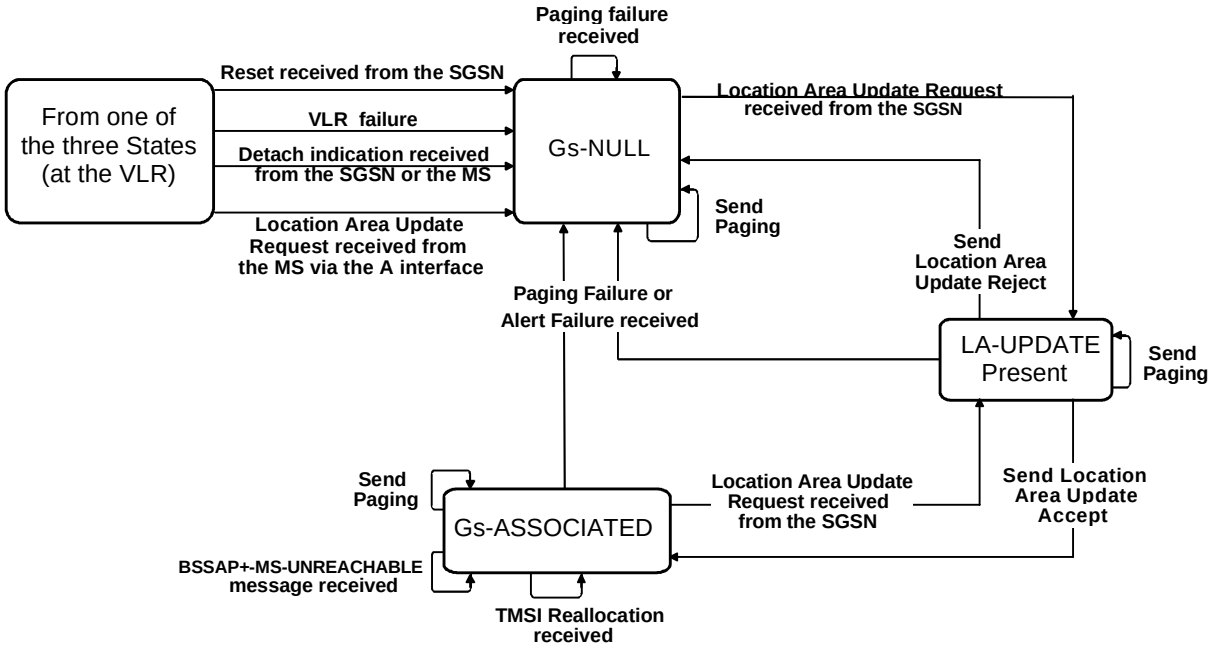


Figure 4.1/3GPP TS 29.018: State diagram at the VLR

4.2 Association at the SGSN

The states and MM context variables associated to the Gs interface in the SGSN are specified in this subclause. The state diagram at the SGSN is shown in figure 4.2. The state diagram does not include the message error handling specified in clause 16.

4.2.1 MM context variables at the SGSN

VLR-Reliable: Boolean:

Set to 'false' when the SGSN has received a reset indication from the VLR. The SGSN may request to the MS, upon reception of the next routeing area update (either periodic routeing area update or combined routeing and location area update) procedure, to re-attach to non-GPRS services if the MS is still IMSI attached to non-GPRS services. Alternatively the SGSN may upon reception of a combined routeing and location area update request or a periodic routeing area update from a MS that is still attached for non-GPRS service, perform immediately the location update for non-GPRS services procedure.

SGSN-Reset: Boolean:

Set to 'true' when the SGSN restarts after a failure. The 'SGSN-Reset' variable is unique within an SGSN and it applies to all the MM context stored in the SGSN.

4.2.2 States at the SGSN

Gs-NULL:

There is no association with a VLR for the MS and therefore the SGSN considers that the MS is IMSI detached of non-GPRS services. In this state the SGSN accepts BSSAP+-PAGING-REQUEST messages to MSs only if the 'SGSN-Reset' restoration indicator in the SGSN is set to 'true'.

LA-UPDATE Requested:

The SGSN has sent a BSSAP+-LOCATION-UPDATE-REQUEST message to the VLR. In this state the SGSN waits for the outcome of the Location Update for non-GPRS procedure at the VLR before sending the response to the MS. In this state the SGSN accepts BSSAP+-PAGING-REQUEST messages.

Gs-ASSOCIATED:

The SGSN stores an association for that MS. In this state the SGSN performs the Location Update for non-GPRS services procedure towards the VLR for MSs in class-A and MSs in class-B mode of operation when the MS moves to a new LA.

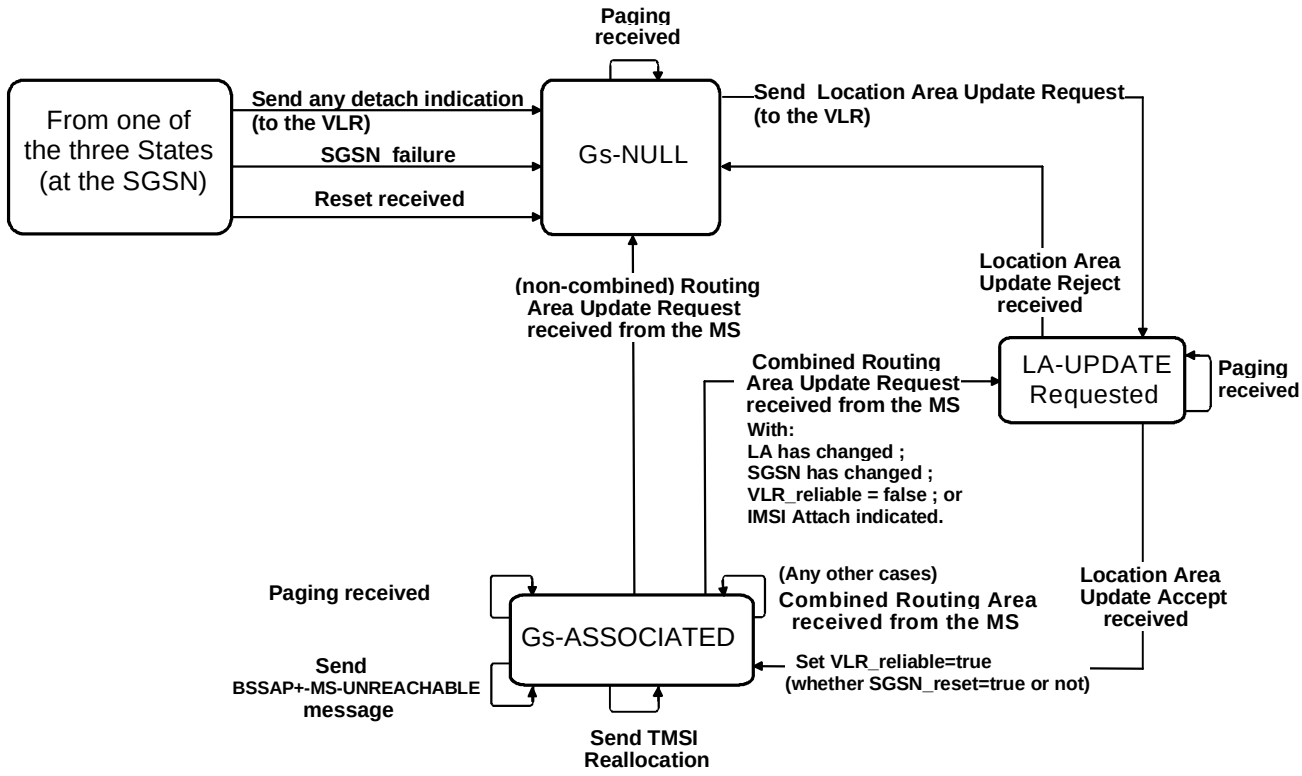


Figure 4.2/3GPP TS 29.018: State diagram at the SGSN

5 Paging for non-GPRS services procedure

5.1 General description

This procedure is used by the VLR to send a BSSAP+-PAGING-REQUEST message to an MS via the GPRS service. This procedure applies to MSs that are simultaneously IMSI attached for GPRS services and non-GPRS services. The procedure can be performed simultaneously with any other procedure at the Gs interface.

5.2 Procedures in the VLR

The VLR shall handle the timers, queuing and retransmission for sending the BSSAP+-PAGING-REQUEST message on the Gs interface in the same way that it handles the sending of a PAGING message on the A interface.

5.2.1 Paging Initiation

When a VLR has to page a GPRS MS it shall check whether the MSC has an SCCP connection for that MS. If no SCCP connection exists the VLR checks the state of the association to an SGSN and the value of the restoration indicators for that MS. The VLR sends BSSAP+-PAGING-REQUEST messages to the SGSN if the state of the association for the MS is Gs-ASSOCIATED, LA-UPDATE-PRESENT or if the state of the association is Gs-NULL and the 'Confirmed by Radio Contact' restoration indicator is set to 'false'. The sending of the BSSAP+-PAGING-REQUEST message does not change the state of the association with the SGSN.

If the 'Confirmed by Radio Contact' restoration indicator is set to 'true', the VLR shall include the Location area identifier IE into the BSSAP+-PAGING-REQUEST message, otherwise (i.e. after a VLR failure) the Location area identifier IE shall not be included. When sending the BSSAP+-PAGING-REQUEST message, the VLR shall start timer T5.

If the state of the association is Gs-NULL and the restoration indicator 'Confirmed by Radio Contact' is set to 'false', the VLR shall also perform a search procedure as specified in 3GPP TS 03.18.

5.2.2 Paging Response

The VLR stops the paging procedure on expiry of timer T5 or on receipt of an SCCP connection establishment containing the Initial L3 message from the MS via the A interface.

5.2.3 Paging Failure

On receipt of a BSSAP+-PAGING-REJECT message before the timer T5 expires, the VLR stops timer T5, the association is moved to the Gs-NULL state and within this state the association is marked with the contents of the Gs Cause IE.

5.2.4 MS unreachable

On receipt of a BSSAP+-MS-UNREACHABLE message before the timer T5 expires, the VLR stops timer T5 and the paging procedure for that paging request towards the SGSN is stopped. The state of the association at the VLR is not changed.

5.3 Procedures in the SGSN

The SGSN accepts BSSAP+-PAGING-REQUEST messages in any state of the association apart from Gs-NULL. Nevertheless the SGSN also accepts BSSAP+-PAGING-REQUEST messages in the Gs-NULL state if the 'SGSN-Reset' restoration indicator at the SGSN is set to 'true'. When an SGSN receives a BSSAP+-PAGING-REQUEST message from a VLR, the SGSN shall first check if the MS is known by the SGSN. The handling of the paging request depends on the state of the association and the MM context variables at the SGSN:

a) The MS is known and the restoration indicator 'SGSN-Reset' at the SGSN is set to 'false':

- If the MS is considered to be IMSI attached for GPRS and non-GPRS services (i.e. the association is not in the state Gs-NULL), the SGSN shall page the MS based on the location information stored in the SGSN.

- If the MS is marked as IMSI detached for GPRS services or IMSI (implicitly or explicitly) detached for non-GPRS services (i.e. the state of the association is Gs-NULL), the SGSN shall return a BSSAP+-PAGING-REJECT message to that VLR indicating in the Gs Cause IE the detach circumstance ('IMSI detached for GPRS services', 'IMSI detached for non-GPRS services' or 'IMSI implicitly detached for non-GPRS services').

- If the MS is marked as unreachable (i.e. the PPF flag is set to 'false') the SGSN shall return a BSSAP+-MS-UNREACHABLE message to that VLR indicating in the Gs Cause IE 'MS unreachable'. The state of the association does not change at the SGSN.

b) The MS is known and the restoration indicator 'SGSN-Reset' at the SGSN is set to 'true':

- If the BSSAP+-PAGING-REQUEST message includes the Location area identifier IE, the SGSN shall page the MS in all the routeing areas served by the SGSN that are included in the location area indicated in the Location area identifier IE.

- If the BSSAP+-PAGING-REQUEST message does not include the Location area identifier IE, the SGSN may page in all the routeing areas served by the SGSN that are also served by the sending VLR.

c) The MS is not known and the restoration indicator 'SGSN-Reset' at the SGSN is set to 'false':

- The SGSN shall return a BSSAP+-PAGING-REJECT message to that VLR indicating in the Gs Cause IE 'IMSI unknown'.

d) The MS is not known and the restoration indicator 'SGSN-Reset' at the SGSN is set to 'true':

- If the VLR provides the Location area identifier IE, the SGSN shall page within the location area indicated by the VLR. Otherwise the SGSN may page in all the routeing areas served by the SGSN that are also served by the sending VLR.

If the SGSN accepts the paging request, the SGSN shall process the BSSAP+-PAGING-REQUEST message before sending the message on the Gb interface. The result of the processing on the BSSAP+-PAGING-REQUEST message is the PAGING CS message (see 3GPP TS 08.18) sent on the Gb interface.

The SGSN shall not retransmit the PAGING CS message.

If within a location area there are cells that do not support GPRS services, the SGSN shall group these cells under a 'null RA'. The SGSN will perform the paging procedure described above within both the RA(s) derived from the location information and the 'null RA(s)' of the corresponding location area(s) (see 3GPP TS 24.008).

NOTE: The eMLPP priority information element relates to relative priorities within the paged MS and not to the priority in the sending of PAGING CS messages by the BSS.

6 Location Update for non-GPRS services procedure

6.1 General description

The location update for non-GPRS services procedure is a general procedure used by MSs in class-A mode of operation and MSs in class-B mode of operation. This procedure allows MSs and network to perform:

- Combined IMSI attach for GPRS and non-GPRS services;

- IMSI attach for non-GPRS services if the MS is already IMSI attached for GPRS services;

- IMSI attach for GPRS services indication to the VLR if the MS is already IMSI attached for non-GPRS services;

- Normal Location Update procedure to the VLR if the MS is IMSI attached for both GPRS and non-GPRS services;

- Reallocation of TMSI to an MS.

The Location Update for non-GPRS services procedures in the Gs interface is always started as a consequence of a direct action by the MS. The combined routeing area update procedure is further specified in 3GPP TS 23.060 and 3GPP TS 24.008.

The Location Update for non-GPRS services procedure is used by the SGSN to forward to the VLR those parts of the combined routeing area update or IMSI attach procedure which belong to the non-GPRS services. This means that non-GPRS related requests which are included in the combined request, are sent from the SGSN to the VLR. The procedure is also used by the SGSN to indicate to the VLR when an IMSI attach to GPRS services has been performed by an MS that was already IMSI attached to non-GPRS services. The SGSN may also forward a BSSAP+-TMSI-REALLOCATION-COMPLETE message from the MS to the VLR.

The VLR shall acknowledge the BSSAP+-LOCATION-UPDATE-REQUEST message. When the VLR processes the request it does not perform authentication because it relies on the SGSN's security functions.

When an MS is IMSI attached for GPRS and non-GPRS services, any implicit detach timer in the VLR shall be stopped. Instead the Paging Proceed Flag in the SGSN is used to determine the likely availability of the MS to the network. Upon reception of the periodic Routeing Area Update message the SGSN does not report to the VLR, and the state of the association at the SGSN is not changed. When the MS performs a detach only from the GPRS system the GPRS detach indication to the VLR shall cause the VLR's implicit detach timer to be restarted from its initial value.

If the SGSN performs an implicit detach for both GPRS and non-GPRS traffic, then the SGSN shall indicate to the VLR a BSSAP+-IMSI-DETACH-INDICATION message with cause 'Implicit SGSN initiated IMSI detach from non-GPRS service', as further described in clause 'Implicit IMSI detach from non-GPRS service procedure' (the implicit IMSI detach message indicates that the MS is unavailable for both GPRS and non-GPRS services).

The IMSI attach for GPRS services to the VLR, when the MS is already IMSI attached for non-GPRS services, is requested by the MS sending a combined IMSI attach for GPRS and non-GPRS services message to the SGSN, as further specified in 3GPP TS 23.060 and 3GPP TS 24.008.

6.2 Procedures in the SGSN

The Location Update for non-GPRS services is initiated with a combined routeing area update procedure or a IMSI/GPRS attach procedure. On receipt of a Routeing Area Update message, the SGSN shall handle the GPRS related request as specified in 3GPP TS 24.008. The Location Update for non-GPRS services procedure may be handled by the SGSN in parallel to the Update Location procedure to the HLR. The SGSN shall wait for the outcome of both location update procedures towards the VLR and the HLR before sending the response message to the MS (see 3GPP TS 24.008).

6.2.1 Location Update Initiation

If timer T6-1 is not running, the SGSN shall start the Location Update for non-GPRS service procedure when it receives from the MS:

- An Attach request indicating combined IMSI and GPRS attach;
- An Attach request indicating GPRS attach while IMSI attached;
- A Combined Routeing and Location Area Update request indicating IMSI attach;
- A Combined Routeing and Location Area Update request indicating that the Location Area has changed;
- A Combined Routeing and Location Area Update request, if the state of the association is Gs-NULL; or
- A Combined Routeing and Location Area Update request when the SGSN serving the MS has changed.

The number of the VLR is derived from the RAI where the MS is camping. The SGSN starts Timer T6-1. The BSSAP+-LOCATION-UPDATE-REQUEST message includes the old Location Area Identifier received from the MS. The SGSN shall also include the new Location Area Identifier where the MS is currently camping. The new LAI is derived from the RAI.

The BSSAP+-LOCATION-UPDATE-REQUEST message includes the type of location update performed by the MS in the GPRS location update type IE. If the MS has performed a combined attach request or a combined routing and

location area update request with IMSI attach, the SGSN indicates 'IMSI attach', otherwise the SGSN indicates 'Normal location update'.

The BSSAP+-LOCATION-UPDATE-REQUEST message shall include the TMSI status if received from the MS.

If timer T6-1 is running:

If the SGSN receives from the MS:

- An Attach request indicating combined IMSI and GPRS attach;
- An Attach request indicating GPRS attach while IMSI attached; or
- A Combined Routeing and Location Area Update request with or without IMSI attach.

Then:

- If the new LAI is the same as in the outstanding request, the SGSN shall not process this new request and shall wait for the VLR's response to the ongoing procedure; or
- If the new LAI is different but is in the same VLR as the outstanding request:
 - any response from the VLR to the oustanding request is ignored;
 - Timer T6-1 shall be stopped and reset; and
 - The SGSN shall start the Location Update for non-GPRS service procedure; or
- If the new LAI is different, and is in a different VLR to the outstanding request:
 - Any response from the previously addressed VLR to the oustanding request is ignored;
 - Timer T6-1 shall be stopped and reset; and
 - the SGSN shall start the Location Update for non-GPRS service procedure.

When the SGSN receives from the MS a Routeing Area Update request and the SGSN serving the MS has changed, the SGSN shall stop and reset timer T6-1.

6.2.2 Location Update Response

If the SGSN receives a BSSAP+-LOCATION-UPDATE-ACCEPT message from the VLR, the SGSN shall:

stop timer T6-1; and

- Move the state of the association to Gs-ASSOCIATED;
- Set the the MM context variable 'VLR-Reliable' to 'true'; and
- Indicate to the MS the acceptance of the VLR to the Location Update procedure. The message to the MS includes the Routeing Area Identity, from which the MS is able to extract the location area identity for which the location update procedure succeeded (see 3GPP TS 24.008).

The SGSN shall wait for the outcome of the Location Update for non-GPRS service procedure towards the VLR before sending a response to location update procedure to the MS. Any Reject cause that needs to be reported to the MS is specified in 3GPP TS 24.008.

If the VLR included the Mobile Identity IE in the BSSAP+-LOCATION-UPDATE-ACCEPT message, the SGSN shall forward the information received to the MS. If the Mobile Identity IE contains a new TMSI it will cause the MS to perform a TMSI reallocation procedure, while an IMSI causes the MS to deallocate its TMSI. In case a new TMSI was allocated for the MS the SGSN shall send to the VLR the BSSAP+-TMSI-REALLOCATION-COMPLETE message when the SGSN receives the Attach Complete or the Routeing Area Complete message from the MS.

6.2.3 Location Update Failure

If the SGSN receives a BSSAP+-LOCATION-UPDATE-REJECT message from the VLR, the SGSN shall:

- Stop timer T6-1;
- Move the state of the association to Gs-NULL; and
- Indicate to the MS the rejection of the VLR of the Location Update procedure as specified in 3GPP TS 24.008. The Reject cause value sent by the VLR shall be forwarded to the MS.

6.2.4 Abnormal cases

If timer T6-1 expires, the SGSN shall abort the Location Update for non-GPRS service procedure and indicate this to the MS with the Reject cause value 'MSC temporarily not reachable'. The state of the association to the VLR shall be Gs-NULL.

If the SGSN receives a BSSAP+LOCATION-UPDATE-ACCEPT message and timer T6-1 is not running then:

- If timer T8 is running (see clause 8), the message shall be ignored;
- If timer T9 is running (see clause 9), the message shall be ignored; or
- If timers T8 and T9 are not running:
 - If the state of the association to the VLR is GS-ASSOCIATED, the message shall be ignored; or
 - If the state of the association to the VLR is different than GS-ASSOCIATED, the message shall be treated as a message incompatible with the protocol state of the SGSN (see subclause 16.3).

6.3 Procedures in the VLR

When a VLR receives a BSSAP+-LOCATION-UPDATE-REQUEST message it shall check whether the IMSI is known. If the IMSI is not known the VLR shall retrieve the MM context of the MS from the HLR.

6.3.1 Location Update Response

If the Location Update is accepted by the VLR and, if necessary by the HLR, the VLR shall:

- Move the association to the Gs-ASSOCIATED state;
- Set the restoration indicator 'Confirmed by Radio Contact' to 'true';
- Update the association by storing the SGSN number included in the BSSAP+-LOCATION-UPDATE-REQUEST message; and
- Send a BSSAP+-LOCATION-UPDATE-ACCEPT message to the sending SGSN. This message includes the Location Area Identification received in the new Cell Global Identity IE in the previous BSSAP+-LOCATION-UPDATE-REQUEST message.

6.3.2 Location Update Failure

If the Location Update is rejected by the VLR it shall:

- Send a BSSAP+-LOCATION-UPDATE-REJECT message to the SGSN with the appropriate reject cause as indicated in 3GPP TS 24.008; and
- Move the association from any state to Gs-NULL.

6.3.3 TMSI reallocation procedure

If the VLR decides to reallocate the TMSI to the MS it shall include the new TMSI in the BSSAP+-LOCATION-UPDATE-ACCEPT message. If the VLR decides to deallocate the TMSI of the MS it shall include the IMSI of the MS in the BSSAP+-LOCATION-UPDATE-ACCEPT message. After sending the BSSAP+-LOCATION-UPDATE-ACCEPT message with a new TMSI the VLR starts timer T6-2.

NOTE: In the BSSAP+-LOCATION-UPDATE-REQUEST the SGSN may indicate, that there is no valid TMSI available in the MS. This information may be used by the VLR to decide whether to reallocate a new TMSI to the MS.

Upon receipt of the BSSAP+-TMSI-REALLOCATION-COMPLETE message, the VLR stops the timer T6-2 and considers the new TMSI as valid.

If an IMSI was sent to the MS, the VLR considers the old TMSI as deleted.

If no BSSAP+-TMSI-REALLOCATION-COMPLETE message is received by the VLR before the timer T6-2 expires, the VLR aborts the TMSI reallocation procedure. The VLR may still perform the TMSI reallocation procedure via the A interface. The outcome of the TMSI reallocation procedure does not change the state of the association. The VLR uses the IMSI or the new TMSI for paging.

6.3.4 Abnormal cases

i) MM signalling via A interface

If the VLR receives a Location Update request or an IMSI detach indication from the MS by the A interface when the state of the association in the VLR is not Gs-NULL, the VLR shall move the state of the association to Gs-NULL.

ii) Additional Location Update Request

If the state of the association in the VLR is in the LA-UPDATE PRESENT state and a BSSAP+-LOCATION-UPDATE-REQUEST message is received, then:

- If the message is from the same SGSN and indicates the same New Location Area as the outstanding location update request, then this additional BSSAP+-LOCATION-UPDATE-REQUEST message shall be ignored;

- If the message is from the same SGSN but indicates a different New Location Area to the outstanding location update request, then this additional BSSAP+-LOCATION-UPDATE-REQUEST message shall be treated and the VLR shall not send any response to the previous BSSAP+-LOCATION-UPDATE-REQUEST message; or

- If the message is from a different SGSN (indicating either the same or different New Location Area) to the outstanding location update request, then this additional BSSAP+-LOCATION-UPDATE-REQUEST message shall be treated and the VLR shall not send any response to the previous BSSAP+-LOCATION-UPDATE-REQUEST message.

iii) Detach signalling from SGSN

If the state of the association in the VLR is in the LA-UPDATE PRESENT state and either a BSSAP+-GPRS-DETACH-INDICATION or a BSSAP+-IMSI-DETACH-INDICATION message is received, then, the Location Update for non-GPRS services procedure shall be abandoned in the VLR (neither a BSSAP+LOCATION-UPDATE-ACCEPT nor a BSSAP+LOCATION-UPDATE-REJECT messages is sent) and the further actions described in clauses 8 or 9 or 10 are followed.

7 Non-GPRS alert procedure

7.1 General description

This procedure is used by the VLR to request from an SGSN an indication when activity (either signalling or data transmission) from an MS is detected. This procedure can be invoked at any time by the VLR. The BSSAP+-ALERT-REQUEST message shall be acknowledged by the SGSN.

7.2 Procedures in the VLR

7.2.1 Alert Initiation

The VLR may start the Non-GPRS alert procedure at any time. When the VLR wants to request to an SGSN that further activity from an MS shall reported by the SGSN, the VLR shall send an BSSAP+-ALERT-REQUEST message to that SGSN. The VLR starts timer T7 when the BSSAP+-ALERT-REQUEST message is sent.

7.2.2 Alert Response

When a BSSAP+-ALERT-ACK message is received, the VLR shall stop the timer T7. The state of the association is not changed.

7.2.3 Alert failure

If a BSSAP+-ALERT-REJECT message is received, the VLR shall stop the timer T7, move the state of the association to Gs-NULL and within this state the association is marked with the contents of the Gs Cause IE.

7.2.4 Alert Indication

The VLR shall not change the state of the association upon reception of an BSSAP+-MS-ACTIVITY-INDICATION message.

7.2.5 Abnormal cases

If no BSSAP+-ALERT-ACK message is received before the timer T7 expires, the VLR shall retransmit the BSSAP+-ALERT-REQUEST message a maximum of N7 times. If no BSSAP+-ALERT-ACK message is received after that, a report shall be made to the O&M system. The state of the association is not changed.

7.3 Procedures in the SGSN

7.3.1 Alert response

The SGSN may receive a BSSAP+-ALERT-REQUEST message at any state of the association. Upon receipt of an BSSAP+-ALERT-REQUEST message from the VLR and if the IMSI is known in the SGSN, the SGSN shall reply with a BSSAP+-ALERT-ACK message and set the NGAF.

7.3.2 Alert failure

If a BSSAP+-ALERT-REQUEST message is received for an IMSI that is unknown at the SGSN, the SGSN shall return a BSSAP+-ALERT-REJECT message to the VLR indicating the Gs Cause IE value 'IMSI unknown'.

7.3.3 Alert indication

The SGSN shall to report to the VLR upon detection of any activity (either signalling or data) from the MS if the NGAF is set. If the SGSN detects GPRS signalling that leads to a procedure towards the VLR, the SGSN shall follow this procedure and reset the NGAF. If the SGSN detects activity that does not lead to any procedure towards the VLR, the SGSN shall send an BSSAP+-MS-ACTIVITY-INDICATION message towards the VLR and reset the NGAF.

8 Explicit IMSI detach from GPRS services procedure

8.1 General description

This procedure is used by the SGSN to indicate to the VLR that the MS has been IMSI detached from GPRS service and therefore the association between the SGSN and the VLR has to be deactivated. This procedure only applies to MSs that are not in the Gs-NULL state at the SGSN. The procedures specified in this subclause apply to GPRS detach indication initiated by the MS or by the network as specified in 3GPP TS 23.060.

The procedure is also used by the SGSN to indicate to the VLR when a Location Update procedure has been rejected by the SGSN.

The Explicit IMSI detach from GPRS services procedure aborts any other ongoing procedure related to this MS on the Gs interface in the SGSN and in the VLR.

The VLR and the MS should be synchronised as to whether the PBCCH or the BCCH is used, for any of the subsequent paging. In order to achieve this, the SGSN shall attempt to inform the VLR about the detach event by using a retry scheme if the initial delivery of the BSSAP+-GPRS-DETACH-INDICATION message fails.

8.2 Procedures in the SGSN

8.2.1 Explicit GPRS detach initiation

The SGSN shall send a BSSAP+-GPRS-DETACH-INDICATION message to a VLR if:

- The SGSN receives a GPRS only detach from the MS;
- The SGSN performs network-initiated GPRS detach procedure; or
- The combined Routing and Location Area Update procedure is rejected at the SGSN.

If the SGSN receives a Detach Request from an MS and the state of the association to a VLR for that MS is not Gs-NULL, the SGSN shall check the detach type indicated in the message. If the MS is indicating GPRS detach the SGSN shall send a BSSAP+-GPRS-DETACH-INDICATION message to the VLR indicating 'MS initiated IMSI detach from GPRS service'.

If the SGSN decides to perform a network-initiated GPRS detach and the state of the association to a VLR for that MS is not Gs-NULL, the SGSN shall send a BSSAP+-GPRS-DETACH-INDICATION message to the VLR indicating 'SGSN initiated IMSI detach from GPRS service'.

If the combined Routing and Location Area Update procedure is rejected at the SGSN for a MS with an association state different from Gs-NULL, the SGSN shall send a BSSAP+-GPRS-DETACH-INDICATION to the VLR indicating 'GPRS services not allowed'. The SGSN then sends, for example, an Attach Reject message as specified in 3GPP TS 24.008.

After the sending of the BSSAP+-GPRS-DETACH-INDICATION message, the SGSN shall move the state of the association to Gs-NULL. The SGSN shall start timer T8 upon transmission of the BSSAP+-GPRS-DETACH-INDICATION message and if timer T6-1 is running, timer T6-1 shall be stopped and reset.

8.2.2 Explicit GPRS detach Response

The SGSN shall not wait for the reception of the BSSAP+-GPRS-DETACH-ACK message before sending (if needed) the confirmation of the detach to the MS.

8.2.3 Abnormal cases

If no BSSAP+-GPRS-DETACH-ACK message is received by the SGSN to a previous BSSAP+-GPRS-DETACH-INDICATION message before timer T8 expires, the SGSN shall repeat the BSSAP+-GPRS-DETACH-INDICATION message a maximum of N8 times. If no BSSAP+-GPRS-DETACH-ACK message is received after that, a report shall be made to the O&M system. The state of the association during the acknowledgement procedure remains Gs-NULL.

8.3 Procedures in the VLR

When a VLR receives a BSSAP+-GPRS-DETACH-INDICATION message, the VLR shall send a BSSAP+-GPRS-DETACH-ACK message to the sending SGSN. The state of the association for the MS shall be moved from any state to Gs-NULL. The VLR marks the association as 'IMSI detached for GPRS services' with the reason indicated in the IMSI detach from GPRS service type IE.

If the VLR's implicit detach timer is not running then, the VLR shall set and restart the implicit detach timer upon reception of a BSSAP+-GPRS-DETACH-INDICATION message. If the VLR's implicit detach timer is running (ie the state of the association was already Gs-NULL) then, the reception of a BSSAP+-GPRS-DETACH-INDICATION message shall not affect the VLR's implicit detach timer.

9 Explicit IMSI detach from non-GPRS services procedure

9.1 General description

This procedure is used by the SGSN to indicate to the VLR that the MS has performed IMSI detach from non-GPRS services and therefore the association between the SGSN and the VLR has to be deactivated. This procedure only applies to MSs that are not in the Gs-NULL state at the SGSN . The procedures specified in this subclause only apply to IMSI detach or combined IMSI and GPRS detach requests.

The explicit IMSI detach from non-GPRS services procedure aborts any other ongoing procedure related to this MS on the Gs interface in the SGSN and in the VLR.

The VLR and the MS should be synchronised as to whether the PBCCH or the BCCH is used, for any of the subsequent paging.. In order to achieve this, the SGSN shall attempt to inform the VLR about the detach event by using a retry scheme if the initial delivery of the BSSAP+-IMSI-DETACH-INDICATION message fails.

9.2 Procedures in the SGSN

9.2.1 Explicit IMSI detach initiation

When an SGSN receives a Detach Request from an MS which is not in the Gs-NULL state, it shall check the detach type indicated. If the MS is indicating IMSI detach or combined IMSI and GPRS detach the SGSN shall send an BSSAP+-IMSI-DETACH-INDICATION message to the VLR indicating 'Explicit MS initiated IMSI detach from non-GPRS service' or 'Combined explicit MS initiated IMSI detach from GPRS and non-GPRS services'.

After the sending of the BSSAP+-IMSI-DETACH-INDICATION message to the VLR, the SGSN shall move the state of the association to Gs-NULL. The SGSN shall start timer T9 upon transmission of the BSSAP+-IMSI-DETACH-INDICATION message and if timer T6-1 is running, timer T6-1 shall be stopped and reset..

9.2.2 Explicit IMSI detach Response

If the detach type received from the MS indicated IMSI only detach or combined IMSI and GPRS detach not due to switch off, the SGSN shall wait for the reception of the BSSAP+-IMSI-DETACH-ACK message before sending the confirmation of the detach to the MS.

9.2.3 Abnormal cases

i) with switch off

If the SGSN sent a BSSAP+-IMSI-DETACH-INDICATION message for a combined IMSI and GPRS detach due to switch off and timer T9 expires, the SGSN shall repeat the BSSAP+-IMSI-DETACH-INDICATION message a maximum of N9 times.

ii) with no switch off

If the SGSN sent a BSSAP+-IMSI-DETACH-INDICATION message for a IMSI only detach or a combined IMSI and GPRS detach not due to switch off and timer T9 expires, the SGSN shall repeat the BSSAP+-IMSI-DETACH-INDICATION message a maximum of N9 times. If no BSSAP+-IMSI-DETACH-ACK is received after that the SGSN shall send the confirmation of the detach to the MS.

9.3 Procedures in the VLR

When a VLR receives an BSSAP+-IMSI-DETACH-INDICATION message , the VLR shall send an BSSAP+-IMSI-DETACH-ACK message to the sending SGSN. The state of the association for the MS shall be moved from any state to Gs-NULL. If the BSSAP+-IMSI-DETACH-INDICATION message indicated 'Explicit MS initiated IMSI detach from non-GPRS service', the VLR marks the association as 'IMSI detached for non-GPRS services'. If the BSSAP+-IMSI-DETACH-INDICATION message indicated 'Combined explicit MS initiated IMSI detach from GPRS and non-GPRS services', the VLR marks the association as 'IMSI detached for GPRS and non-GPRS services'.

10 Implicit IMSI detach from non-GPRS services procedure

10.1 General description

This procedure is used by the SGSN to indicate when an internal SGSN timer mechanism has caused the SGSN to delete the GMM context of an MS or mark its GMM context as detached. This procedure only applies to MSs that are not in the Gs-NULL state at the SGSN.

The implicit IMSI detach from non-GPRS services procedure aborts any other ongoing procedure related to this MS on the Gs interface in the SGSN and in the VLR.

The VLR and the MS should be synchronised as to whether the PBCCH or the BCCH is used, for any of the subsequent paging. In order to achieve this, the SGSN shall attempt to inform the VLR about the detach event by using a retry scheme if the initial delivery of the BSSAP+-IMSI-DETACH-INDICATION message fails.

10.2 Procedures in the SGSN

When the implicit IMSI detach from non-GPRS services procedure is started for an MS by the above mentioned internal SGSN timer mechanism, the SGSN shall send a BSSAP+-IMSI-DETACH-INDICATION message to the VLR indicating 'Implicit SGSN initiated IMSI detach from non-GPRS service'.

After the sending of the BSSAP+-IMSI-DETACH-INDICATION message, the SGSN shall move the state of the association to Gs-NULL. The SGSN shall start timer T10 upon transmission of the BSSAP+-IMSI-DETACH-INDICATION message.

If no BSSAP+-IMSI-DETACH-ACK message is received by the SGSN to a previous BSSAP+-IMSI-DETACH-INDICATION message before timer T10 expires, the SGSN shall repeat the BSSAP+-IMSI-DETACH-INDICATION message a maximum of N10 times. The state of the association during the acknowledgement procedure remains Gs-NULL.

10.3 Procedures in the VLR

When a VLR receives the BSSAP+-IMSI-DETACH-INDICATION message and the state of the association is not Gs-NULL, the state of the association for the MS shall be moved to Gs-NULL. The VLR marks the association as 'IMSI implicitly detached for GPRS and non-GPRS services'. The VLR shall also send a BSSAP+-IMSI-DETACH-ACK message to the sending SGSN.

11 VLR failure procedure

11.1 General description

This procedure is used by the VLR to inform to the associated SGSNs about the recovery from an internal failure that has affected the association with the SGSNs.

The VLR recovery procedure shall be handled in such a way that the signalling load on the VLR and SGSN does not create any overload problem.

11.2 Procedures in the VLR

11.2.1 VLR Reset Initiation

In the event of a failure at the VLR which has resulted in the loss of SGSN association information on some MSs, the VLR shall move from any state to the Gs-NULL state for all the associations with SGSNs per MS. The VLR shall also set the 'Confirmed by Radio Contact' restoration indicator to 'false' (see 3GPP TS 23.007). The VLR shall not send any BSSAP+- MS-INFORMATION-REQUEST or BSSAP+-MM-INFORMATION-REQUEST messages to MSs with the SGSN association in the Gs-NULL state.

When the VLR restarts a BSSAP+-RESET-INDICATION message shall be sent to all the SGSNs connected to the VLR by the Gs interface. This message indicates to the SGSN that for the MSs with an association to that VLR, the associations are no longer reliable. The VLR shall also start timer T11.

11.2.2 VLR Reset Response

Upon receipt of a BSSAP+-RESET-ACK message, the VLR shall stop the timer T11.

11.2.3 Abnormal cases

If the VLR does not receive a BSSAP+-RESET-ACK message from that SGSN before the T11 timer expires, the VLR shall retransmit the BSSAP+-RESET-INDICATION message. The retransmission is repeated a maximum of N11 times. If no BSSAP+-RESET-ACK is received after that a report shall be made to the O&M system.

11.3 Procedures in the SGSN

Upon receipt of a BSSAP+-RESET-INDICATION message from the VLR, the SGSN is informed that all the associations with that VLR for all the MSs registered in the SGSN are no longer reliable because the VLR may have lost information about the state of the MSs and during the failure the VLR may have missed signalling messages. The SGSN shall set the 'VLR-Reliable' MM context variable to 'false' and shall move all the associations containing the restarted VLR to the Gs-NULL state. The detach procedures for deleting the association are still applicable (clauses 8, 9 and 10). If the 'VLR-Reliable' MM context variable is set to 'false', upon reception of a Combined Routeing and Location Area update request or a periodic Routeing Area Update from the MS that is attached for non-GPRS service, the SGSN may request the re-attach to non-GPRS services, or may alternatively immediately perform the Location Update for non-GPRS services procedure towards the VLR.

The SGSN sends a BSSAP+-RESET-ACK message to the VLR. This indicates to the VLR that all the associations for the MSs which have an association with that VLR will be moved to the Gs-NULL state.

12 SGSN failure procedure

12.1 General description

This procedure is used by the SGSN to inform to the associated VLRs about the recovery from an internal failure that has affected the association with the VLRs.

The SGSN recovery procedure shall be handled in such a way that the signalling load on the VLR and SGSN does not create any overload problem.

12.2 Procedures in the SGSN

12.2.1 SGSN Reset Initiation

In the event of a failure at the SGSN which has resulted in the loss of VLR association information on some MSs, the SGSN shall move from any state to the Gs-NULL state for all the associations with VLRs per MS. The SGSN shall also set the 'SGSN-Reset' MM context variable to 'true' and start the timer T12-1. When the timer T12-1 expires the 'SGSN-Reset' MM context variable is set to 'false'. The value of the timer T12-1 shall be longer that the periodic routing area update timer at the SGSN.

A BSSAP+-RESET-INDICATION message shall be sent to all the VLRs connected to the SGSN by Gs interfaces. The BSSAP+-RESET-INDICATION message indicates to the VLR that all the associations with that particular SGSN for all the MSs registered in the VLR are no longer reliable. The normal procedures for updating the association are still applicable (clauses 6, 8, 9 and 10). The SGSN shall also start timer T12-2.

12.2.2 SGSN Reset Response

Upon receipt of a BSSAP+-RESET-ACK message, the SGSN shall stop the timer T12-2.

12.2.3 Abnormal cases

If the SGSN does not receive a BSSAP+-RESET-ACK message from that VLR before the T12-2 timer expires, the SGSN shall retransmit the BSSAP+-RESET-INDICATION message. The retransmission is repeated a maximum of N12 times. If no BSSAP+-RESET-ACK is received after a report shall be to made the O&M system.

12.3 Procedures in the VLR

Upon receipt of a BSSAP+-RESET-INDICATION message from the SGSN, the VLR is informed that all the associations with that SGSN for all the MSs registered in the SGSN are no longer reliable because the SGSN may have lost information about the state of the MSs for that VLR and during the failure the SGSN may have missed signalling

messages. The VLR shall set the 'Confirmed by Radio Contact' restoration indicator to 'false' in all the associations containing the restarted SGSN. If the 'Confirmed by Radio Contact' restoration indicator is 'false' the VLR may send paging messages on both the Gs and the A interface.

The VLR sends a BSSAP+-RESET-ACK message to the SGSN. This indicates to the SGSN that all the associations for the MSs which have an association with that SGSN will be moved to the Gs-NULL state.

13 HLR failure

This chapter decribes the SGSN behaviour towards the VLR as a consequence of an HLR reset.

13.1 General description

In the case of an HLR failure, the HLR informs the associated SGSNs about the recovery from an internal failure that has affected the association with the SGSNs according to the HLR reset procedure specified in 3GPP TS 29.002.

This information is used in the SGSN to trigger the VLR to perform a location update towards the HLR in order to restore the HLR subscriber data.

13.2 Procedures in the SGSN

Upon receipt of a HLR reset indication from the HLR, the SGSN shall set the NGAF for all registered MSs in the SGSN for which a valid MSC/VLR-association exists.

Upon detection of any activity (either signalling or data) from the MS, the SGSN shall report to the VLR if the NGAF is set for this MS. If the SGSN detects GPRS signalling that leads to a procedure towards the VLR, the SGSN shall follow this procedure and reset the NGAF. If the SGSN detects activity that does not lead to any procedure towards the VLR, the SGSN shall send an BSSAP+-MS-ACTIVITY-INDICATION message towards the VLR and reset the NGAF. The activity indication may be delayed by the SGSN for a maximum operator-configuration depending time period to avoid high signalling load.

14 MS Information procedure

14.1 General description

The MS Information procedure is used by the VLR to request specific parameters about the MS. If the target MS for an MS Information procedure or a Provide Subscriber Info procedure (see 3GPP TS 03.18 and 3GPP TS 29.002) is GPRS attached (i.e. the state of the association to Gs-ASSOCIATED) the VLR may decide to perform the procedure via GPRS. The outcome of the MS Information procedure does not change the state of the association at the VLR or SGSN.

14.2 Procedures in the VLR

If the target MS for the MS information procedure is GPRS attached and the state of the association for the MS Gs-ASSOCIATED, the VLR may initiate the MS information procedure by transferring a BSSAP+-MS-INFORMATION-REQUEST message to the SGSN. If the state of the association is LA-UPDATE PRESENT, the VLR shall wait until this state is exited. The VLR starts the timer T14. The BSSAP+-MS-INFORMATION-REQUEST message specifies the requested information parameters in the Information requested information element.

Upon receipt of a BSSAP+-MS-INFORMATION-RESPONSE the VLR shall stop timer T14. If no BSSAP+-MS-INFORMATION-RESPONSE for that MS is received before the expiry of timer T14the VLR shall stop the Gs interface MS information procedure. The VLR may perform other actions to obtain the information about the MS (e.g. retry, or send a DTAP IDENTITY REQUEST message on the A interface).

14.3 Procedures in the SGSN

The SGSN shall examine the type of information that is requested and if it is stored in its database shall use this information in its response to the VLR. The BSSAP+-MS-INFORMATION-RESPONSE message contains the information parameters as requested by the VLR. In A/Gb mode, the Mobile location information indicates a request for Cell Global Identity and Location information age. In Iu mode, the Mobile location information indicates a request for Service Area Identification and Location information age. In this case, the SGSN shall use the Location Report Control procedure (see 3GPP TS 25.413) in order to retrieve the SA.

If the SGSN receives an Information requested information element containing a 'not supported' value, then the value part of the Mobile station state information element in the BSSAP+-MS-INFORMATION-RESPONSE message shall be set to 'Information requested not supported'.

If the information is not locally available and it is a request for mobile identity information, the SGSN forwards the IDENTITY REQUEST message to the MS indicated in the message unless the GPRS activities of the MS are suspended. Upon receipt of the IDENTITY RESPONSE message from the MS, the SGSN shall send a BSSAP+-MS-INFORMATION-RESPONSE message. The BSSAP+-MS-INFORMATION-RESPONSE message contains the information parameters as requested by the VLR. If the GPRS activities of the MS are suspended the SGSN shall return a BSSAP+-MS-INFORMATION-RESPONSE message indicating in the Mobile station state IE 'SUSPENDED'. If the requested information is not available or obtainable at the SGSN, the SGSN shall return a BSSAP+-MS-INFORMATION-RESPONSE message to the VLR without the requested information. The SGSN should include the Mobile station state IE in all BSSAP+-MS-INFORMATION-RESPONSE messages.

If the IMSI is not known at the SGSN, the SGSN shall return a BSSAP+-MS-INFORMATION-RESPONSE message indicating in the Mobile station state IE 'IMSI unknown'.

15 MM information procedure

15.1 General description

The MM information procedure may be performed by the VLR via GPRS if the target MS for the MM information procedure is IMSI attached to both GPRS and non-GPRS services (i.e. the state of the association is Gs-ASSOCIATED). The outcome of the MM Information procedure does not change the state of the association at the VLR or SGSN.

15.2 Procedures in the VLR

If the target MS for the MM information procedure is GPRS attached class A or B MS, the state of the association is Gs-ASSOCIATED, the VLR may initiate the MM information procedure by transferring a BSSAP+-MM-INFORMATION-REQUEST message to the SGSN.

15.3 Procedures in the SGSN

If the state of the association at the SGSN is not Gs-NULL, the SGSN shall forward the MM-INFORMATION message to the MS indicated.

16 Error Handling and Future Compatibility

16.1 General

This clause specifies procedures for the handling of unknown, unforeseen, and erroneous protocol data by the receiving entity. These procedures are called "error handling procedures", but in addition to providing recovery mechanisms for error situations they define a compatibility mechanism for future extensions of the protocol.

In this clause the following terminology is used:

- an IE is defined to be syntactically incorrect in a message if it contains at least one value defined as "reserved", or if its value part violates coding rules. However, it is not a syntactical error that an IE specifies in its Length Indicator a greater length than defined in the relevant clause; and

- a message is defined to have semantically incorrect contents if it contains information which, possibly dependant on the state of the receiver, is in contradiction to the resources of the receiver and/or to the procedural part of 3GPP TS 29.018.

When a receiving entity detects the need to send a BSSAP+-MOBILE-STATUS message (see errors detailed below), the entity shall copy the IMSI IE value (if included) of the incorrect message to the IMSI IE on the BSSAP+-MOBILE-STATUS message. The message in error is also included in the BSSAP+-MOBILE-STATUS message. Both the receiving and the sending entity shall abandon the procedure related to the incorrect message and return to the state from where the procedure related to the incorrect message was started.

Both the receiving and the sending entity shall inform the O&M entity upon sending or receiving a BSSAP+-MOBILE-STATUS message.

The next subclauses in this clause shall be applied in order of precedence.

16.2 Message too short

When a message is received that is too short to contain a complete message type information element, that message shall be ignored.

16.3 Unknown or unforeseen message type

If a message is received with a message type not defined or not implemented by the receiver it shall ignore the message. A BSSAP+-MOBILE-STATUS message with the Gs Cause Value set to "message unknown" and the Erroneous message IE containing the received message shall be returned.

If a message is received that is not compatible with the protocol state, a BSSAP+-MOBILE-STATUS message with the Gs Cause Value set to "message not compatible with the protocol state" and the erroneous message shall be returned.

If a message is received that is not defined to be received by that entity (i.e. the message is sent in the wrong direction) it shall be treated as unknown message and the message shall be ignored. A BSSAP+-MOBILE-STATUS message with the Gs Cause Value set to "message unknown" and the Erroneous message IE containing the received message shall be returned.

16.4 Missing mandatory information element

When on receipt of a message, and a "missing mandatory IE" error is diagnosed, the receiver shall ignore the message and return a BSSAP+-MOBILE-STATUS message with the Gs Cause Value set to "missing mandatory information element" and shall return the Erroneous message information element containing the received message.

16.5 IEs unknown or unforeseen in the message

All IEs unknown or unforeseen in a message shall be ignored.

16.6 Out of sequence IEs

All IEs that are out of sequence shall be ignored.

16.7 Repeated IEs

If an information element with format T, TV, or TLV is repeated in a message in which repetition of the information element is not specified, only the contents of the information element appearing first shall be handled and all subsequent repetitions of the information element shall be ignored. When repetition of information elements is specified, only the contents of specified repeated information elements shall be handled. If the limit on repetition of information elements is exceeded, the contents of information elements appearing first up to the limit of repetitions shall be handled and all subsequent repetitions of the information element shall be ignored.

16.8 Syntactically incorrect mandatory IE.

On receipt of a message which contains a syntactically incorrect mandatory IE, the receiver shall ignore the message and return a BSSAP+-MOBILE-STATUS message with the Gs Cause Value set to "invalid mandatory information" and shall return the Erroneous message information element containing the received message.

16.9 Syntactically incorrect optional IEs

All optional IEs that are syntactically incorrect in a message shall be treated as not present in the message.

16.10 Conditional IE errors

When a VLR or SGSN receives a message and diagnoses a "missing conditional IE" error or an "unexpected conditional IE" error or when it receives a message containing at least one syntactically incorrect conditional IE which is required to be present in the message, a VLR or SGSN shall ignore the message and return a BSSAP+-MOBILE-STATUS message with the Gs Cause Value set to "conditional IE error" and shall return the Erroneous message information element containing the received message.

When a VLR or SGSN receives a message containing a syntactically incorrect conditional IE which is not required to be present in the message, nor required to be absent in the message, then a VLR or SGSN shall ignore that IE.

16.11 IEs with semantically incorrect contents

When an IE with semantically incorrect contents is received, the foreseen reactions of the procedural part of 3GPP TS 29.018 are performed.

If however no such reactions are specified, the receiving entity shall ignore that IE and treat the rest of the message. If, because this IE was ignored, the rest of the message can no longer be handled then the receiving entity shall return a BSSAP+-MOBILE-STATUS message with the Gs Cause Value set to "semantically incorrect message" and shall return the Erroneous message information element containing the received message.

17 Message functional definitions and contents

This clause defines the structure of the messages that are sent between the SGSN and the VLR.

17.1 Message Contents

17.1.1 BSSAP+-ALERT-ACK message

This message is sent by the SGSN to the VLR to acknowledge a previous BSSAP+-ALERT-REQUEST message.

Table 17.1.1/3GPP TS 29.018: BSSAP+-ALERT-ACK message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10

17.1.2 BSSAP+-ALERT-REJECT message

This message is sent from the SGSN to the VLR to indicate that the SGSN could not identify the IMSI indicated in the BSSAP+-ALERT-Request message.

Table 17.1.2/3GPP TS 29.018: BSSAP+-ALERT-REJECT message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
Gs Cause	Gs Cause 18.4.7	M	TLV	3

17.1.2.1 Gs Cause

The value part which is typically sent for this information element in this message is 'IMSI unknown'.

17.1.3 BSSAP+-ALERT-REQUEST message

This message is sent by the VLR to the SGSN to request an indication when next activity from the MS is detected.

Table 17.1.3/3GPP TS 29.018: BSSAP+-ALERT-REQUEST message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10

17.1.4 BSSAP+-DOWNLINK-TUNNEL-REQUEST message

This message is sent from the non-GSM MSC/VLR to the SGSN to convey a tunneling payload to the MS identified by the specified IMSI.

Table 17.1.4/3GPP TS 29.018: BSSAP+-DOWNLINK-TUNNEL-REQUEST message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
VLR number	VLR number 18.4.26	M	TLV	5-11
Downlink Tunnel Payload Control and Info	Downlink Tunnel Payload Control and Info 18.4.3	M	TLV	3-223

17.1.5 BSSAP+-GPRS-DETACH-ACK message

This message is sent by the VLR to the SGSN to acknowledge a previous BSSAP+-GPRS-DETACH-Indication message. The type of detach acknowledged is indicated in the GPRS detach type IE.

Table 17.1.5/3GPP TS 29.018: BSSAP+-GPRS-DETACH-ACK message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10

17.1.6 BSSAP+-GPRS-DETACH-INDICATION message

This message is sent by the SGSN to the VLR to indicate a GPRS detach performed from the MS or the SGSN. The type of detach is indicated in the GPRS detach type IE.

Table 17.1.6/3GPP TS 29.018: BSSAP+-GPRS-DETACH-INDICATION message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
SGSN number	SGSN number 18.4.22	M	TLV	5-11
IMSI detach from GPRS service type	IMSI detach from GPRS service type 18.4.17	M	TLV	3
Cell global identity	Cell global identity 18.4.1	O	TLV	10
Service area identification	Service area identification 18.4.21b	O	TLV	9

17.1.6.1 Cell global identity (A/Gb mode only)

In A/Gb mode, the SGSN shall include the Cell global identity where the mobile was in the last radio contact.

17.1.6.2 Service area identification (Iu mode only)

In Iu mode, the SGSN should include the Service area identification where the mobile was in the last radio contact.

17.1.7 BSSAP+-IMSI-DETACH-ACK message

This message is sent by the VLR to the SGSN to acknowledge a previous BSSAP+-IMSI-DETACH-Indication message. The type of detach acknowledged is indicated in the IMSI detach type IE.

Table 17.1.7/3GPP TS 29.018: BSSAP+-IMSI-DETACH-ACK message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10

17.1.8 BSSAP+-IMSI-DETACH-INDICATION message

This message is sent by the SGSN to the VLR to indicate an IMSI detach performed from the MS. The type of detach is indicated in the IMSI detach type IE.

Table 17.1.8/3GPP TS 29.018: BSSAP+-IMSI-DETACH-INDICATION message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
SGSN number	SGSN number 18.4.22	M	TLV	5-11
Detach type	IMSI detach from non-GPRS service type 18.4.11	M	TLV	3
Cell global identity	Cell global identity 18.4.1	O	TLV	10
Location information age	Location information age 18.4.14	O	TLV	4
Service area identification	Service area identification 18.4.21b	O	TLV	9

17.1.8.1 Cell global identity (A/Gb mode only)

In A/Gb mode, the SGSN shall include the Cell global identity where the mobile was in the last radio contact.

17.1.8.2 Location information age

If the detach is due to implicit detach and the Cell global identity is available, then the SGSN should include the Location information age.

17.1.8.3 Service area identification (Iu mode only)

In Iu mode, the SGSN should include the Service area identification where the mobile was in the last radio contact.

17.1.9 BSSAP+-LOCATION-UPDATE-ACCEPT message

This message is sent by the VLR to the SGSN to indicate that update or IMSI attach in the VLR has been completed.

Table 17.1.9/3GPP TS 29.018: BSSAP+-LOCATION-UPDATE-ACCEPT message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
Location area identifier	Location area identifier 18.4.14	M	TLV	7
New TMSI, or IMSI	Mobile identity 18.4.17	O	TLV	6-10

17.1.9.1 New TMSI, or IMSI

This information element represents the identity to be used for (and then by) the MS.

If this information element is an IMSI, then the mobile station is not allocated any TMSI (and deletes any TMSI accordingly). If this information element is a TMSI, then the mobile station will use this TMSI as the new temporary identity (the MS deletes its old TMSI and stores the new TMSI). If neither a TMSI nor an IMSI are included in this information element, the old TMSI, if any available, will be kept.

17.1.10 BSSAP+-LOCATION-UPDATE-REJECT message

This message is sent by the VLR to the SGSN to indicate that location update or IMSI attach has failed.

Table 17.1.10/3GPP TS 29.018: BSSAP+-LOCATION-UPDATE-REJECT message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
Reject cause	Reject cause 18.4.21	M	TLV	3

17.1.11 BSSAP+-LOCATION-UPDATE-REQUEST message

This message is sent by the SGSN to the VLR either to request update of its location file (normal update) or to request IMSI attach.

Table 17.1.11/3GPP TS 29.018: BSSAP+-LOCATION-UPDATE-REQUEST message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
SGSN number	SGSN number 18.4.22	M	TLV	5-11
Update type	GPRS location update type 18.4.6	M	TLV	3
New Cell global identity	Cell global identity 18.4.1	M	TLV	10
Mobile station classmark	Mobile station classmark 1 18.4.18	M	TLV	3
Old location area identifier	Location area identifier 18.4.14	O	TLV	7
TMSI status	TMSI status 18.4.24	O	TLV	3
New service area identification	Service area identification 18.4.21b	O	TLV	9

17.1.11.1 Old location area identifier

This information element should be included. It is derived from the old routing area identification received in the ROUTING AREA UPDATING REQUEST message defined in 3GPP TS 24.008.

17.1.11.2 New cell global identity

In A/Gb mode, the cell global identity which shall be included is the one where the MS is in the current radio contact.

In Iu mode, the cell global identity which shall be included indicates where the MS is in the current location area. The cell identity part of this information shall be ignored by the VLR.

17.1.11.3 TMSI status

This information element shall be included if the TMSI status received in the ATTACH REQUEST or ROUTING AREA UPDATING REQUEST message from the MS indicates, that no valid TMSI is available in the MS.

17.1.11.4 Mobile station classmark

This information element does not serve any useful purpose, but shall be included for reasons of compatibility with earlier versions of the protocol. To ease interworking with old VLR equipment, the SGSN shall encode the contents of this information element as: revision level 'GSM phase 2', 'early classmark sending supported', 'encryption algorithm A5/1 supported', and RF power capability 'class 1'.

17.1.11.5 New service area identification

In Iu mode, the service area identification which should be included is the one where the MS is in the current radio contact.

17.1.12 BSSAP+-MM-INFORMATION-REQUEST

This message is sent by the VLR to the SGSN to provide the MS with subscriber specific information.

Table 17.1.12/3GPP TS 29.018: BSSAP+-MM-INFORMATION-REQUEST message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
MM information	MM information 18.4.16	O	TLV	3-n

17.1.12.1 MM information

This information element should be included in this message.

17.1.13 BSSAP+-MOBILE-STATUS message

This message is sent by both the SGSN or the VLR to indicate an error.

Table 17.1.13/3GPP TS 29.018: BSSAP+-MOBILE-STATUS message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	O	TLV	6-10
Gs Cause	Gs Cause 18.4.7	M	TLV	3
Erroneous message	Erroneous message 18.4.5	M	TLV	3-n

17.1.13.1 IMSI

If the MS is identified by the IMSI, then this information element shall be included.

17.1.14 BSSAP+-MS-ACTIVITY-INDICATION message

This message is sent by the SGSN to the VLR to indicate that activity from an MS has been detected.

Table 17.1.14/3GPP TS 29.018: BSSAP+-MS-ACTIVITY-INDICATION message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
Cell global identity	Cell global identity 18.4.1	O	TLV	10
Service area identification	Service area identification 18.4.21b	O	TLV	9

17.1.14.1 Cell global identity (A/Gb mode only)

In A/Gb mode, the SGSN shall include the cell global identity where the MS was in the last radio contact.

17.1.14.2 Service area identification (Iu mode only)

In Iu mode, the SGSN should include the Service area identification where the mobile was in the last radio contact.

17.1.15 BSSAP+-MS-INFORMATION-REQUEST message

This message is sent from the VLR to the SGSN to request information associated with the indicated IMSI. The type of information requested is specified in the Information requested IE.

Table 17.1.15/3GPP TS 29.018: BSSAP+-MS-INFORMATION-REQUEST message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
Information requested	Information requested 18.4.13	M	TLV	3

17.1.16 BSSAP+-MS-INFORMATION-RESPONSE message

This message is sent from the SGSN to the VLR as a response to a previous BSSAP+- MS-INFORMATION - REQUEST message. (At least one of the requested identities shall be sent).

Table 17.1.16/3GPP TS 29.018: BSSAP+-MS-INFORMATION-RESPONSE message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
TMSI	TMSI 18.4.23	O	TLV	6
PTMSI	PTMSI 18.4.20	O	TLV	6
IMEI	IMEI 18.4.8	O	TLV	10
IMEISV	IMEISV 18.4.9	O	TLV	10
Cell global identity	Cell global identity 18.4.1	O	TLV	10
Location information age	Location information age 18.4.15	O	TLV	4
Mobile station state	Mobile station state 18.4.19	O	TLV	3
Service area identification	Service area identification 18.4.21b	O	TLV	9

17.1.16.1 IMEI

This information element should be included if it was requested in the BSSAP+-MS-INFORMATION-REQUEST message and if this information is obtainable.

17.1.16.2 IMIESV

This information element should be included if it was requested in the BSSAP+-MS-INFORMATION-REQUEST message and if this information is obtainable.

17.1.16.3 Cell global identity (A/Gb mode only)

In A/Gb mode, cell global identity where the MS was in the last radio contact.

This information element should be included if it was requested in the BSSAP+-MS-INFORMATION-REQUEST message and if this information is obtainable.

17.1.16.4 Location information age

Time in minutes since the MS last established a radio transaction.

This information element should be included if it was requested in the BSSAP+-MS-INFORMATION-REQUEST message and if this information is obtainable.

17.1.16.5 Mobile station state

This information element should be included in this message, irrespective of the information requested.

17.1.16.6 TMSI

This information element should be included if it was requested in the BSSAP+-MS-INFORMATION-REQUEST message and if this information is obtainable. .

17.1.16.7 Service area identification (Iu mode only)

In Iu mode, service area identification where the MS was in the last radio contact.

This information element should be included if it was requested in the BSSAP+-MS-INFORMATION-REQUEST message and if this information is obtainable.

17.1.17 BSSAP+-MS-UNREACHABLE message

This message is sent from the SGSN to the VLR to indicate that, for example, paging could not be performed because the MS is marked as unreachable at the SGSN.

Table 17.1.17/3GPP TS 29.018: BSSAP+-MS-UNREACHABLE message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
Gs Cause	Gs Cause 18.4.7	M	TLV	3

17.1.17.1 Gs Cause

The value part which is typically sent for this information element in this message is 'MS unreachable'.

17.1.18 BSSAP+-PAGING-REJECT message

This message is sent from the SGSN to the VLR to indicate that the delivery of a previous BSSAP+-PAGING-REQUEST message has failed.

Table 17.1.18/3GPP TS 29.018: BSSAP+-PAGING-REJECT message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
Gs Cause	Gs Cause 18.4.7	M	TLV	3

17.1.19 BSSAP+-PAGING-REQUEST message

This message is sent from the VLR to the SGSN and contains sufficient information to allow the paging message to be transmitted by the correct cells at the correct time.

Table 17.1.19/3GPP TS 29.018: BSSAP+-PAGING_REQUEST message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
VLR number	VLR number 18.4.26	M	TLV	5-11
TMSI	TMSI 18.4.23	O	TLV	6
Location area identifier	Location area identifier 18.4.14	O	TLV	7
Channel needed	Channel needed 18.4.2	O	TLV	3
eMLPP Priority	eMLPP Priority 18.4.4	O	TLV	3

17.1.19.1 TMSI

This element is omitted in the exceptional case where the IMSI is used instead of the TMSI as a paging address at the radio interface.

17.1.19.2 Location area identifier

If the location area identifier is not included, then the SGSN shall page the MS in all the cells served by the VLR and the SGSN, unless the SGSN has reliable information about the location of the MS.

17.1.19.3 Channel needed

If the Channel needed Information Element is not present, then the default value is assumed to be " any channel ".

17.1.19.4 eMLPP priority

This information element may be included when the subscriber has a subscription for eMLPP.

17.1.20 BSSAP+-RESET-ACK message

This message is sent from the SGSN or the VLR to acknowledge a previous BSSAP+-RESET-INDICATION message. This message indicates that all the associations to the VLR or the SGSN have been be marked as invalid.

The sending entity (either SGSN or VLR) includes its identity in the BSSAP+-RESET-ACK message.

Table 17.1.20/3GPP TS 29.018: BSSAP+-RESET-ACK message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
SGSN number	SGSN number 18.4.22	C	TLV	5-11
VLR number	VLR number 18.4.26	C	TLV	5-11

17.1.20.1 SGSN number

If the SGSN is the sending entity, then it shall indicate its address by including its SGSN number Information Element. Otherwise (i.e. if the VLR is the sending entity), then the SGSN number Information Element shall not be included.

17.1.20.2 VLR number

If the VLR is the sending entity, then it shall indicate its address by including its VLR number Information Element. Otherwise (i.e. if the SGSN is the sending entity), then the VLR number Information Element shall not be included.

17.1.21 BSSAP+-RESET-INDICATION message

This message is sent from the VLR to the SGSN to indicate that a failure in the VLR has occurred and all the associations to the VLR shall be marked as invalid.

This message is also sent from the SGSN to the VLR to indicate that a failure in the SGSN has occurred and all the associations to the SGSN shall be marked as invalid.

The sending entity (either SGSN or VLR) includes its identity in the BSSAP+-RESET-INDICATION message.

Table 17.1.21/3GPP TS 29.018: BSSAP+-RESET-INDICATION message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
SGSN number	SGSN number 18.4.22	C	TLV	5-11
VLR number	VLR number 18.4.26	C	TLV	5-11

17.1.21.1 SGSN number

If the SGSN is the sending entity, then it shall indicate its address by including its SGSN number Information Element. Otherwise (i.e. if the VLR is the sending entity), then the SGSN number Information Element shall not be included.

17.1.21.2 VLR number

If the VLR is the sending entity, then it shall indicate its address by including its VLR number Information Element. Otherwise (i.e. if the SGSN is the sending entity), then the VLR number Information Element shall not be included.

17.1.22 BSSAP+-TMSI-REALLOCATION-COMPLETE message

This message is sent by the SGSN to the VLR to indicate that TMSI reallocation on the MS has been successfully completed.

Table 17.1.22/3GPP TS 29.018: BSSAP+-TMSI-REALLOCATION-COMPLETE message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
Cell global identity	Cell global identity 18.4.1	O	TLV	10
Service area identification	Service area identification 18.4.21b	O	TLV	9

17.1.22.1 Cell global identity (A/Gb mode only)

The SGSN shall include the cell global identity where the Mobile Station was in the last radio contact.

17.1.22.2 Service area identification (Iu mode only)

In Iu mode, the SGSN should include the Service area identification where the mobile was in the last radio contact.

17.1.23 BSSAP+-UPLINK-TUNNEL-REQUEST message

This message is sent from the SGSN to the non-GSM MSC/VLR to convey the tunneling payload received from the MS identified by the specified IMSI.

Table 17.1.23/3GPP TS 29.018: BSSAP+-UPLINK-TUNNEL-REQUEST message content

Information Element	Type/Reference	Presence	Format	Length
Message type	Message type 18.2	M	V	1
IMSI	IMSI 18.4.10	M	TLV	6-10
SGSN number	SGSN number 18.4.22	M	TLV	5-11
Uplink Tunnel Payload Control and Info	Uplink Tunnel Payload Control and Info 18.4.25	M	TLV	3-223

18 Message format and information element coding

This clause specifies the coding of the Information Elements used in by the BSSAP+ protocol. The spare bits in the coding of an IE shall be set to zero by the sender and shall be ignored by the receiver.

All unassigned codes (whether omitted or explicitely *Unassigned* in the text) shall be treated as unknown (see clause 16).

18.1 Overview

18.2 Message type

Message type uniquely identifies the message being sent. It is a single octet element, mandatory in all messages.

Table 18.2/3GPP TS 29.018: Message type information element

8 7 6 5 4 3 2 1	Message type	*Reference*
0 0 0 0 0 0 0 0	*Unassigned:* treated as an unknown Message type.	18 and 16
0 0 0 0 0 0 0 1	BSSAP+-PAGING-REQUEST	17.1.19
0 0 0 0 0 0 1 0	BSSAP+-PAGING-REJECT	17.1.18
0 0 0 0 0 0 1 1 to 0 0 0 0 0 1 1 0	*Unassigned:* treated as an unknown Message type.	18 and 16
0 0 0 0 0 1 1 1	BSSAP+-DOWNLINK-TUNNEL-REQUEST	17.1.4
0 0 0 0 1 0 0 0	BSSAP+-UPLINK-TUNNEL-REQUEST	17.1.23
0 0 0 0 1 0 0 1	BSSAP+-LOCATION-UPDATE-REQUEST	17.1.11
0 0 0 0 1 0 1 0	BSSAP+-LOCATION-UPDATE-ACCEPT	17.1.9
0 0 0 0 1 0 1 1	BSSAP+-LOCATION-UPDATE-REJECT	17.1.10
0 0 0 0 1 1 0 0	BSSAP+-TMSI-REALLOCATION-COMPLETE	17.1.22
0 0 0 0 1 1 0 1	BSSAP+-ALERT-REQUEST	17.1.3
0 0 0 0 1 1 1 0	BSSAP+-ALERT-ACK	17.1.1
0 0 0 0 1 1 1 1	BSSAP+-ALERT-REJECT	17.1.2
0 0 0 1 0 0 0 0	BSSAP+-MS-ACTIVITY-INDICATION	17.1.14
0 0 0 1 0 0 0 1	BSSAP+-GPRS-DETACH-INDICATION	17.1.6
0 0 0 1 0 0 1 0	BSSAP+-GPRS-DETACH-ACK	17.1.5
0 0 0 1 0 0 1 1	BSSAP+-IMSI-DETACH-INDICATION	17.1.8
0 0 0 1 0 1 0 0	BSSAP+-IMSI-DETACH-ACK	17.1.7
0 0 0 1 0 1 0 1	BSSAP+-RESET-INDICATION	17.1.21
0 0 0 1 0 1 1 0	BSSAP+-RESET-ACK	17.1.20
0 0 0 1 0 1 1 1	BSSAP+-MS-INFORMATION-REQUEST	17.1.15
0 0 0 1 1 0 0 0	BSSAP+-MS-INFORMATION-RESPONSE	17.1.16
0 0 0 1 1 0 0 1	*Unassigned:* treated as an unknown Message type.	18 and 16
0 0 0 1 1 0 1 0	BSSAP+-MM-INFORMATION-REQUEST	17.1.12
0 0 0 1 1 1 0 1	BSSAP+-MOBILE-STATUS	17.1.13
0 0 0 1 1 1 1 0	*Unassigned:* treated as an unknown Message type.	18 and 16
0 0 0 1 1 1 1 1	BSSAP+-MS-UNREACHABLE	17.1.17

18.3 Information Element Identifiers

The next list shows the coding of the Information Element Identifiers used in the present document.

Table 18.3/3GPP TS 29.018: Information Element Identifier coding

8 7 6 5 4 3 2 1	Information element	Reference
0 0 0 0 0 0 0 1	IMSI	18.4.10
0 0 0 0 0 0 1 0	VLR number	18.4.26
0 0 0 0 0 0 1 1	TMSI	18.4.23
0 0 0 0 0 1 0 0	Location area identifier	18.4.14
0 0 0 0 0 1 0 1	Channel Needed	18.4.2
0 0 0 0 0 1 1 0	eMLPP Priority	18.4.4
0 0 0 0 0 1 1 1	TMSI status	18.4.24
0 0 0 0 1 0 0 0	Gs cause	18.4.7
0 0 0 0 1 0 0 1	SGSN number	18.4.22
0 0 0 0 1 0 1 0	GPRS location update type	18.4.6
0 0 0 0 1 0 1 1	*Unassigned:* treated as an unknown IEI.	18 and 16
0 0 0 0 1 1 0 0	*Unassigned:* treated as an unknown IEI.	18 and 16
0 0 0 0 1 1 0 1	Mobile station classmark 1	18.4.18
0 0 0 0 1 1 1 0	Mobile identity	18.4.17
0 0 0 0 1 1 1 1	Reject cause	18.4.21
0 0 0 1 0 0 0 0	IMSI detach from GPRS service type	18.4.11
0 0 0 1 0 0 0 1	IMSI detach from non-GPRS service type	18.4.12
0 0 0 1 0 0 1 0	Information requested	18.4.13
0 0 0 1 0 0 1 1	PTMSI	18.4.20
0 0 0 1 0 1 0 0	IMEI	18.4.8
0 0 0 1 0 1 0 1	IMEISV	18.4.9
0 0 0 1 0 1 1 0	*Unassigned:* treated as an unknown IEI.	18 and 16
0 0 0 1 0 1 1 1	MM information	18.4.16
0 0 0 1 1 0 0 0	Cell Global Identity	18.4.1
0 0 0 1 1 0 0 1	Location information age	18.4.15
0 0 0 1 1 0 1 0	Mobile station state	18.4.19
0 0 0 1 1 0 1 1	Erroneous message	18.4.5
0 0 0 1 1 1 0 0	Downlink Tunnel Payload Control and Info	18.4.3
0 0 0 1 1 1 0 1	Uplink Tunnel Payload Control and Info	18.4.25
0 0 0 1 1 1 1 0	Service Area Identification	18.4.21b
0 0 0 1 1 1 1 1 to 1 1 1 1 1 1 1 1	*Unassigned:* treated as an unknown IEI.	18 and 16

18.4 Information elements

18.4.1 Cell global identity

This information element uniquely identifies one cell.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3 to Octet 10	The rest of the information element is coded as the the value part of the cell global id IE defined in 3GPP TS 08.18 (not including 3GPP TS 08.18 IEI and 3GPP TS 08.18 length indicator).							

Figure 18.4.1/3GPP TS 29.018: Cell global identity IE

18.4.2 Channel needed

The purpose of the *Channel Needed* information element is to indicate which type of channel is needed for the transaction linked to the paging procedure.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	The rest of the information element is coded as the IEI part and the value part of the Channel Needed IE defined in 3GPP TS 24.008.							

Figure 18.4.2/3GPP TS 29.018: Channel needed IE

18.4.3 Downlink Tunnel Payload Control and Info

This information element is used to convey the payload of octets to be delivered to the identified mobile.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	Spare	TOM Protocol Discriminator				E	Tunnel Priority	
Octet 4 to Octet n	Tunnel payload							

TOM Protocol Discriminator: Identifies the protocol using tunnelling of non-GSM signalling. For coding, see 3GPP TS 04.64.

E: Cipher Request. When set to 1 indicates that the SGSN shall cipher the payload, when set to 0 indicates that the SGSN shall not cipher the payload.

Tunnel Priority: Indicates the priority of the Tunnel Payload. For coding, see table 20.1: Association between Tunnel Priority and LLC SAPs.

Figure 18.4.3/3GPP TS 29.018: Downlink Tunnel Payload Control and Info IE

18.4.4 eMLPP Priority

This element indicates the eMLPP-Priority.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	The rest of the information element is coded as the value part of the eMLPP-Priority IE defined in 3GPP TS 08.08 (not including 3GPP TS 08.08 IEI and 3GPP TS 08.08 length indicator).							

Figure 18.4.4/3GPP TS 29.018: eMLPP Priority IE

18.4.5 Erroneous message

The Erroneous message IE is a TLV IE that encapsulates the message in error.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3 - Octet n	Erroneous message including the message type.							

Figure 18.4.5/3GPP TS 29.018: Erroneous message IE

18.4.6 GPRS location update type

The purpose of the GPRS location update type information element is to indicate to the VLR whether an IMSI attach or a normal location update has been performed by the MS.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	GPRS location update type value							

Figure 18.4.6/3GPP TS 29.018: GPRS location update type IE

Table 18.4.6/3GPP TS 29.018: GPRS location update type IE value part

GPRS location update type value (octet 3)

Bits 8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	Shall not be sent in this version of the protocol. If received, shall be treated as '00000010'.
0 0 0 0 0 0 0 1	IMSI attach
0 0 0 0 0 0 1 0	Normal location update
0 0 0 0 0 0 1 1	Shall not be sent in this version of the protocol. If received, to shall be treated as 00000010'.
To	
1 1 1 1 1 1 1 1	

18.4.7 Gs cause

The purpose of the value part of the Gs Cause information element is to indicate an error to the receiving entity. This could be a protocol data error or to indicate to the VLR the reason why a paging procedure could not be performed.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	Gs Cause value							

Figure 18.4.7/3GPP TS 29.018: Gs Cause IE

Table 18.4.7/3GPP TS 29.018: Gs Cause IE value part

Gs Cause value (octet 3) Bits 8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	*Normal, unspecified* in this version of the protocol.
0 0 0 0 0 0 0 1	IMSI detached for GPRS services
0 0 0 0 0 0 1 0	IMSI detached for GPRS and non-GPRS services
0 0 0 0 0 0 1 1	IMSI unknown
0 0 0 0 0 1 0 0	IMSI detached for non-GPRS services
0 0 0 0 0 1 0 1	IMSI implicitly detached for non-GPRS services
0 0 0 0 0 1 1 0	MS unreachable
0 0 0 0 0 1 1 1	Message not compatible with the protocol state
0 0 0 0 1 0 0 0	Missing mandatory information element
0 0 0 0 1 0 0 1	Invalid mandatory information
0 0 0 0 1 0 1 0	Conditional IE error
0 0 0 0 1 0 1 1	Semantically incorrect message
0 0 0 0 1 1 0 0	Message unknown
0 0 0 0 1 1 0 1	Address error
0 0 0 0 1 1 1 0	TOM functionality not supported
0 0 0 0 1 1 1 1	Ciphering request cannot be accommodated
0 0 0 1 0 0 0 0 to 1 1 1 1 1 1 1 1	*Normal, unspecified* in this version of the protocol

NOTE: *'Normal*, unspecified' has the same meaning than in 3GPP TS 24.008, informative Annex H (GSM specific cause values for call control). It is used to report a normal event, and should not be interpreted as syntactically incorrect nor unknown if received.

18.4.8 IMEI

The IMEI is coded as a sequence of BCD digits, compressed two into each octet. The IMEI consists of 15 digits (see 3GPP TS 23.003).

	8	**7**	**6**	**5**	**4**	**3**	**2**	**1**
octet 1	IEI							
octet 2	length indicator							
octet 3	TAC digit 2				TAC digit 1			
octet 4	TAC digit 4				TAC digit 3			
octet 5	TAC digit 6				TAC digit 5			
octet 6	FAC digit 2				FAC digit 1			
octet 7	SNR digit 2				SNR digit 1			
octet 8	SNR digit 4				SNR digit 3			
octet 9	SNR digit 6				SNR digit 5			
octet 10	1	1	1	1	0	0	0	0

Figure 18.4.8/3GPP TS 29.018: IMEI IE

18.4.9 IMEISV

The IMEISV is coded as a sequence of BCD digits, compressed two into each octet. The IMEISV consists of 16 digits (see 3GPP TS 23.003).

	8	7	6	5	4	3	2	1
octet 1	IEI							
octet 2	length indicator							
octet 3	TAC digit 2				TAC digit 1			
octet 4	TAC digit 4				TAC digit 3			
octet 5	TAC digit 6				TAC digit 5			
octet 6	FAC digit 2				FAC digit 1			
octet 7	SNR digit 2				SNR digit 1			
octet 8	SNR digit 4				SNR digit 3			
octet 9	SNR digit 6				SNR digit 5			
octet 10	SVN digit 2				SVN digit 1			

Figure 18.4.9/3GPP TS 29.018: IMEISV IE

18.4.10 IMSI

The IMSI is coded as a sequence of BCD digits, compressed two into each octet. This is a variable length element, and includes a length indicator. The IMSI is defined in 3GPP TS 23.003. It shall not exceed 15 digits (see 3GPP TS 23.003).

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	IMSI digit 1				* parity	0	0	1
Octet 4	IMSI digit 3				IMSI digit 2			
Octet 4+x	IMSI digit i+1				IMSI digit i			

Figure 18.4.10/3GPP TS 29.018: IMSI IE

Where x = (i-2)/2 and i is always even:

* The value of the parity bit (bit 4 in octect 3) indicates:

0 Even number of IMSI digits

1 Odd number of IMSI digits

If the number of IMSI digits is even then bits 5 to 8 of the last octet shall be filled with an end mark coded as 1111.

18.4.11 IMSI detach from GPRS service type

The purpose of the IMSI detach from GPRS service type information element is to indicate to the VLR the type of IMSI detach from GPRS service performed by the MS or the SGSN.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	IMSI detach from GPRS service type value							

Figure 18.4.11/3GPP TS 29.018: IMSI detach from GPRS service type IE

Table 18.4.11/3GPP TS 29.018: IMSI detach from GPRS service type IE value part

IMSI detach from GPRS service type value (octet 3) Bits 8 7 6 5 4 3 2 1
0 0 0 0 0 0 0 0 Interpreted as *reserved* in this version of the protocol
0 0 0 0 0 0 0 1 Network initiated IMSI detach from GPRS service
0 0 0 0 0 0 1 0 MS initiated IMSI detach from GPRS service
0 0 0 0 0 0 1 1 GPRS services not allowed
0 0 0 0 0 1 0 0 to Interpreted as *reserved* in this version of the protocol 1 1 1 1 1 1 1 1

18.4.12 IMSI detach from non-GPRS service type

The purpose of the IMSI detach from non-GPRS service type information element is to indicate to the VLR if the type of IMSI detach from non-GPRS service was explicitly performed by the MS or implicitly performed by the SGSN.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	IMSI detach from non-GPRS service type value							

Figure 18.4.12/3GPP TS 29.018: IMSI detach from non-GPRS service type IE

Table 18.4.12/3GPP TS 29.018: IMSI detach from non-GPRS service type IE value part

IMSI detach from non-GPRS service type value (octet 3) Bits 8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	Interpreted as *reserved* in this version of the protocol
0 0 0 0 0 0 0 1	Explicit MS initiated IMSI detach from non-GPRS service
0 0 0 0 0 0 1 0	Combined explicit MS initiated IMSI detach from GPRS and non-GPRS services
0 0 0 0 0 0 1 1	Implicit SGSN initiated IMSI detach from non-GPRS service
0 0 0 0 0 1 0 0 to 1 1 1 1 1 1 1 1	Interpreted as *reserved* in this version of the protocol

18.4.13 Information requested

The Information requested IE is a TLV IE that indicates to the SGSN the type of information requested by the VLR. The coding of the V field is as follows.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	Information requested value							

Figure 18.4.13/3GPP TS 29.018: Information requested IE

Table 18.4.13/3GPP TS 29.018: Information requested IE value part

Information requested value (octet 3) Bits 8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	Interpreted as *Not supported* in this version of the protocol.
0 0 0 0 0 0 0 1	PTMSI
0 0 0 0 0 0 1 0	IMEI
0 0 0 0 0 0 1 1	IMEISV
0 0 0 0 0 1 0 0	PTMSI and IMEI
0 0 0 0 0 1 0 1	PTMSI and IMEISV
0 0 0 0 0 1 1 0	IMEI and IMEISV
0 0 0 0 0 1 1 1	PTMSI, IMEI, and IMEISV
0 0 0 0 1 0 0 0	Mobile location information
0 0 0 0 1 0 0 1	TMSI
0 0 0 0 1 0 1 0 to 1 1 1 1 1 1 1 1	Interpreted as *Not supported* in this version of the protocol.

NOTE: The behaviour of the receiver in the case of a *Not supported* value is described in Sub-clause 14.3, *Procedures in the SGSN*.

18.4.14 Location area identifier

This element uniquely identifies one Location Area.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length Indicator							
Octet 3 - Octer 7	The rest of the information element is coded as the value part of the location area identifier IE defined in 3GPP TS 08.18 (not including 3GPP TS 08.18 IEI and 3GPP TS 08.18 length indicator).							

Figure 18.4.14/3GPP TS 29.018: Location area identifier IE

18.4.15 Location information age

The Location information age IE is a TLV IE that indicates the elapsed time in minutes since the last network contact of the mobile station.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3 **Octet 4**	The rest of the IE is coded as the value part of the AgeOfLocationInformation as specified in 3GPP TS 29.002.							

Figure 18.4.15/3GPP TS 29.018: Location information age IE

18.4.16 MM information

The MM information IE is a TLV IE that encapsulates the user information that the SGSN forwards to the MS.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length Indicator							
Octet 3 **–** **Octet n**	User information: This field is composed of one or more of the information elements of the MM information message as defined in 3GPP TS 24.008, excluding the Protocol discriminator, Skip indicator and Message type. This field includes the IEI and length indicatior of the other information elements.							

Figure 18.4.16/3GPP TS 29.018: MM information IE

18.4.17 Mobile identity

The purpose of the *Mobile identity* information element is to provide either:

- The International Mobile Subscriber Identity (IMSI);
- The Temporary Mobile Subscriber Identity (TMSI);
- The International Mobile Equipment Identity (IMEI); or
- The International Mobile Equipment Identity together with the Software Version number (IMEISV).

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length Indicator							
Octet 3 **-** **Octet n**	The rest of the information element is coded as the value part of the mobile identity IE defined in 3GPP TS 24.008 (not including 3GPP TS 24.008 IEI and 3GPP TS 24.008 length indicator).							

Figure 18.4.17/3GPP TS 29.018: Mobile identity IE

18.4.18 Mobile station classmark 1

The purpose of the *Mobile Station Classmark 1* information element is to provide the network with information concerning aspects of high priority of the mobile station equipment.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	The rest of the information element is coded as the value part of the mobile station classmark 1 IE defined in 3GPP TS 24.008 (not including 3GPP TS 24.008 IEI)							

Figure 18.4.18/3GPP TS 29.018: Mobile station classmark 1 IE

18.4.19 Mobile station state

The Mobile station state IE is a TLV IE that indicates to the VLR the GMM and GSM states of the MS in the SGSN. The coding of the V field is as follows.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	Mobile station state value							

Figure 18.4.19/3GPP TS 29.018: Mobile station state IE

Table 18.4.19/3GPP TS 29.018: Mobile station state IE value part

Mobile station state value (octet 3) Bits 8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	IDLE or PMM-DETACHED
0 0 0 0 0 0 0 1	STANDBY or PMM-IDLE, 0 PDP contexts active
0 0 0 0 0 0 1 0	STANDBY or PMM-IDLE, 1 or more PDP contexts active
0 0 0 0 0 0 1 1	SUSPENDED, 0 PDP contexts active
0 0 0 0 0 1 0 0	SUSPENDED, 1 or more PDP contexts active
0 0 0 0 0 1 0 1	READY or PMM-CONNECTED, 0 PDP contexts active
0 0 0 0 0 1 1 0	READY or PMM-CONNECTED, 1 or more PDP contexts active
0 0 0 0 0 1 1 1	IMSI unknown
0 0 0 0 1 0 0 0	Information requested not supported
0 0 0 0 1 0 0 1 to 1 1 1 1 1 1 1 1	Shall not be sent in this version of the protocol. If received, shall be treated as '00001000'.

18.4.20 PTMSI

The PTMSI consists of 4 octets. It can be coded using a full hexadecimal representation (see 3GPP TS 23.003).

	8	7	6	5	4	3	2	1
octet 1	IEI							
octet 2	length indicator							
octet 3	PTMSI octet 1							
octet 4	PTMSI octet 2							
octet 5	PTMSI octet 3							
octet 6	PTMSI octet 4							

Figure 18.4.20/3GPP TS 29.018: PTMSI IE

18.4.21 Reject cause

The purpose of the *Reject Cause* information element is to indicate the reason why a request from the mobile station is rejected by the network .

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length Indicator							
Octet 3	The rest of the information element is coded as the value part of the reject cause IE defined in 3GPP TS 24.008, not including 3GPP TS 24.008 IEI.							

Figure 18.4.21/3GPP TS 29.018: Reject cause IE

18.4.21b Service Area Identification

This information element uniquely identifies one service area.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3 to Octet 9	The rest of the information element is coded as the the value part of the SAI IE defined in 3GPP TS 25.413 (not including 3GPP TS 25.413 IEI and 3GPP TS 25.413 length indicator).							

Figure 18.4.27/3GPP TS 29.018: Service Area Identification IE

18.4.22 SGSN number

The SGSN number is coded as a sequence of TBCD digits (as specified in 3GPP TS 29.002), compressed two into each octet. The Number is in international E.164 format as indicated by Octet 3 which coding is specified in 3GPP TS 29.002. This is a variable length information element, and includes a length indicator. The value part of the SGSN number information element (not including IEI, Length indicator and Octet 3) shall not exceed 15 digits.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	1	0	0	1	0	0	0	1
Octet 4	digit 2				digit 1			
Octet n	digit i+1				digit i			

Figure 18.4.22/3GPP TS 29.018: SGSN number IE

18.4.23 TMSI

The TMSI consists of 4 octets. It can be coded using a full hexadecimal representation (see 3GPP TS 23.003).

	8	7	6	5	4	3	2	1
octet 1	IEI							
octet 2	length indicator							
octet 3	TMSI octet 1							
octet 4	TMSI octet 2							
octet 5	TMSI octet 3							
octet 6	TMSI octet 4							

Figure 18.4.23/3GPP TS 29.018: TMSI IE

18.4.24 TMSI status

The purpose of the TMSI status information element is to indicate to the VLR whether a valid TMSI is available in the MS.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	Spare							TMSI flag

Figure 18.4.24/3GPP TS 29.018: TMSI status IE

Table 18.4.24/3GPP TS 29.018: TMSI status IE value part

TMSI flag (octet 3) Bit 1 0 no valid TMSI available 1 valid TMSI available Bits 2-8 in octet 3 are spare and shall be coded all equal to 0.

18.4.25 Uplink Tunnel Payload Control and Info

This information element is used to convey the payload of octets received from the mobile to the appropriate non-GSM MSC/VLR.

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	Spare	TOM Protocol Discriminator				E	Tunnel Priority	
Octet 4 to Octet n	Tunnel payload							

TOM Protocol Discriminator: Identifies the protocol using tunnelling of non-GSM signalling. For coding, see 3GPP TS 04.64.

E: Cipher Request. When set to 1 indicates that the SGSN received the payload in ciphered form, when set to 0 indicates that the SGSN did not receive the payload in ciphered form.

Tunnel Priority: Indicates the priority of the Tunnel Payload. For coding, see Table 20.1: Association between Tunnel Priority and LLC SAPs.

Figure 18.4.25/3GPP TS 29.018:Upnlink Tunnel Payload Control and Info IE

18.4.26 VLR number

The VLR number is coded as a sequence of TBCD digits (as specified in 3GPP TS 29.002), compressed two into each octet. The Number is in international E.164 format as indicated by Octet 3 which coding is specified in 3GPP TS 29.002. This is a variable length information element, and includes a length indicator. The value part of the VLR number information element (not including IEI, length indicator and Octet 3), shall not exceed 15 digits.

Table 18.4.26/3GPP TS 29.018: VLR number IE

	8	7	6	5	4	3	2	1
Octet 1	IEI							
Octet 2	Length indicator							
Octet 3	1	0	0	1	0	0	0	1
Octet 4	digit 2				digit 1			
Octet n	digit i+1				digit i			

19 List of system variables

19.1 Timers

This subclause lists the management timers specified for the operation of the BSSAP+ protocol. All the implementation shall support the range of values specified below. The specific value of the timers shall be under the control of the operator.

Table 19.1/3GPP TS 29.018: Management Timers

Timer name	Default value	Timer range	Granularity	Notes	Relation to other timers
T5	-	2 s to20 s	100 ms	Guards the Paging procedure at the VLR.	Value is correlated to DRX parameter Split PG CYCLE (max possible = 16 s) Default should be set acc. to max split cycle supported by the SGSN (operator choice)
T6-1	-	10 s to 90 s	1 s	Guards the Location Update procedure.	It should be higher than 2 times the maximum transmission time in the Gs interface, plus the supervision timer of the Update Location procedure [3GPP TS 29.002]
T6-2	40 s	5 s to 60 s	1 s	Guards the TMSI reallocation procedure.	It should be higher than 2 times the maximum transmission time in the Gs interface, plus 4 times T3350 [3GPP TS 24.008]
T7	4 s	1 s to 30 s	1 s	Guards the Non-GPRS alert procedure.	None.
T8	4 s	1s to 30 s	1 s	Guards the Explicit IMSI detach from GPRS services procedure.	None.
T9	4 s	1 s to 30 s	1 s	Guards the Explicit IMSI detach from non-GPRS services procedure.	None.
T10	4 s	1 s to 30 s	1 s	Guards the Implicit IMSI detach from non-GPRS services procedure.	None.
T11	4 s	1 s to 120 s	1 s	Guards the VLR reset procedure.	None.
T12-1	-	8 - 60x384+8 s	1 min	Controls the resetting of the 'SGSN-Reset' variable.	It should be longer than the longest Periodic RAU timer running on the SGSN, plus the transmission delay on the radio interface.
T12-2	4 s	1 s to 120 s	1 s	Guards the SGSN reset procedure.	None.
T14	-	4 s to 36 s	1 s	Guards the MS Information procedure.	None
NOTE: The Default value is the recommended value.					

19.2 Retry counters

This subclause lists the management retry counters specified for the operation of the BSSAP+ protocol. The values indicated are recommended values.

Table 19.2/3GPP TS 29.018: Management Retry counters

Retry mnemonic	Retry value	Notes
N7	2	Recommended value
N8	2	Recommended value
N9	2	Recommended value
N10	2	Recommended value
N11	2	Recommended value
N12	2	Recommended value

20 Procedures for Tunnelling Non-GSM Signalling

This procedure is used to tunnel non-GSM signalling messages between an MS and a non-GSM MSC/VLR.

20.1 Procedures in the non-GSM MSC/VLR

When the non-GSM MSC/VLR has a message to be tunnelled to an MS, whose Gs state is not Gs-NULL, it shall send a BSSAP+-DOWNLINK-TUNNEL-REQUEST message to the SGSN associated with the MS. If LLC ciphering is required, the cipher request field E shall be set to 1. The Tunnel Priority field for the payload shall be set as required. On receiving a BSSAP+-UPLINK-TUNNEL-REQUEST message from an SGSN, the action taken by the non-GSM MSC/VLR is technology dependent.

20.2 Procedures in the SGSN

A message received by the SGSN from an MS or sent by the SGSN to an MS on one of the Tunneling of Messages (TOM) LLC SAPs is called a *TOM Protocol Envelope* (see 3GPP TS 04.64). The *TOM Protocol Envelope* is composed of the *TOM Protocol Header* immediately followed by a *Message Capsule*.

Upon receipt of a *TOM Protocol Envelope* with a *TOM Protocol Header* indicating the presence of one or more non-GSM signalling messages, the SGSN shall determine the non-GSM MSC/VLR to which the *Message Capsule* in the *TOM Protocol Envelope* shall be forwarded. The SGSN shall make this determination based upon the RAI of the MS, the *TOM Protocol Discriminator* field in the *TOM Protocol Header*, and *TOM Protocol Discriminator* specific information in the remaining octets (if any) in the *TOM Protocol Header*. The SGSN shall then forward a BSSAP+-UPLINK-TUNNEL-REQUEST message to the selected non-GSM MSC/VLR with the received *Message Capsule* in the *Tunnel Payload* field. The *Protocol Discriminator* field in the BSSAP+-UPLINK-TUNNEL-REQUEST message shall be set based on the *TOM Protocol Discriminator* in the *TOM Protocol Envelope*. *Tunnel Priority* field in the BSSAP+-UPLINK-TUNNEL-REQUEST message shall be set based on the LLC SAP on which the *TOM Protocol Envelope* was received. The *E* field shall be set to 1 if the *TOM Protocol Envelope* was received by the LLC in ciphered form, otherwise it shall be set to 0.

Upon receipt of a BSSAP+-DOWNLINK-TUNNEL-REQUEST message from a non-GSM MSC/VLR, the SGSN shall construct a *TOM Protocol Envelope* by mapping the *Tunnel Payload* field to the *Message Capsule* portion of the *TOM Protocol Envelope*. The *TOM Protocol Header* shall be constructed based on the *Protocol Discriminator* in the BSSAP+-DOWNLINK-TUNNEL-REQUEST message. The SGSN shall then send the *TOM Protocol Envelope* to the MS on a specific LLC SAP. That LLC SAP shall be determined by the *Tunnel Priority* field in the BSSAP+-DOWNLINK-TUNNEL-REQUEST message. LLC ciphering shall be enabled or disabled based upon the value of the *E* field in this message. If the SGSN is unable to send the *TOM Protocol Envelope* to the indicated MS for any reason, including the inability to accommodate the ciphering request as indicated in the BSSAP+-DOWNLINK-TUNNEL-REQUEST message, then it shall send a BSSAP+-MOBILE-STATUS message to the non-GSM MSC/VLR with an appropriate *Gs Cause* code.

The association between the LLC SAPs and the *Tunnel Priority* shall be as in the following table, where 00 is top-most priority and 11 is lowest priority.

Table 20.1: Association between Tunnel Priority and LLC SAPs

Tunnel Priority	LLC SAP
00	TOM2
01	Not defined
10	TOM8
11	Not defined

Annex A (informative): Change history

TSG CN#	Spec	Version	CR	New Version	Subject	Comment/TSG doc#/Date
Apr 1999	GSM 29.018	6.3.0				Transferred to 3GPP CN1
CN#03	29.018			3.0.0		Approved at CN#03
CN#4	29.018	3.0.0	001	3.1.0		Approved CN#4
CN#5	29.018	3.1.0	001	3.2.0	Gs Interface Changes to Support Tunnelling of non-GSM Messages	CR 001 were not implemented correctly in v 3.1.0,
CN#5	29.018	3.1.0	002	3.2.0	Clarification of the null RA and other corrections.	CR 002 were not implemented correctly in v 3.1.0,
CN#5	29.018	3.1.0	003	3.2.0	TMSI requested by the MSC trough the Gs interface	CR 003 were not implemented correctly in v 3.1.0,
CN#5	29.018	3.1.0	005	3.2.0	TMSI status indication	Approved in CN#5 as CR001r1, NP-99268
CN#5	29.018	3.1.0	006	3.2.0	Explicit IMSI detach, abnormal case SGSN side	Approved in CN#5 as CR002, NP-99268
CN#5	29.018	3.1.0	004	3.2.0	Clarify that no acknowledgement is made for TMSI deallocation	
CN#7	29.018	3.2.0	003r2	3.3.0	SGSN reaction upon a RAU request after VLR failure	NP-000091
CN#7	29.018	3.2.0	007r3	3.3.0	Introduction of the Service Area Identification	NP-000101
CN#7	29.018	3.2.0	009	3.3.0	Encoding of MS classmark in LUP Request	NP-000091
CN#9	29.018	3.3.0	010	3.4.0	Reject cause in case of expiry of T6-1	NP- 000441/ N1-000911
	29.018	3.4.0		3.4.1		editorial correction of misimplementation of CR010. A single quote is missing in the cause value in clause 6.2.4
CN#10	29.018	3.4.1	011	3.5.0	Terminology corrections	Cat F, WI=TEI, NP-000674 / N1-001267 Also the specification refrence name is changed to 3GPP TS.
CN#11	29.018	3.5.0	012r1	3.6.0	Correction of length indication for Uplink and Downlink Tunnel Request message	NP-010126 03-2001
CN#13	29.018	3.6.0	013	3.7.0	Clarify that no acknowledgement is made for TMSI deallocation	Cat F, WI=GPRS, NP-010491 / N1-011169 09-2001
CN#13	29.018	3.6.0	015	3.7.0	Explicit IMSI detach, abnormal case SGSN side	Cat F, WI=GPRS, NP-010491 / N1-011171 09-2001
CN#13	29.018	3.6.0	017	3.7.0	Correction of the length of the Service Area Identification	Cat F, WI=GSM/UMTS Interworking, NP-010494 / N1-011173 09-2001
CN#14	29.018	3.7.0	019	3.8.0	Clarification of the periodic routing area update procedure	Cat A, WI=GPRS, NP-010646 / N1-011451 12-2001
CN#14	29.018	3.7.0	022	3.8.0	Correction of the Location Update for non-GPRS service procedure	Cat F, WI=TEI, NP-010653 / N1-011808 12-2001

TSG CN#	Spec	Version	CR	New Version	Subject	Comment/TSG doc#/Date
CN#15	29.018	3.8.0	026	3.9.0	Addition of Mobile Station States for UMTS	Cat F, WI= GSM/UMTS Interworking NP-020037 / N1-020199 03-2002

History

Document history		
V3.2.0	January 2000	Publication
V3.3.0	March 2000	Publication
V3.4.0	September 2000	Publication
V3.4.1	October 2000	Publication
V3.5.0	December 2000	Publication
V3.6.0	March 2001	Publication
V3.7.0	September 2001	Publication
V3.8.0	December 2001	Publication
V3.9.0	March 2002	Publication